ELECTRICAL REVIEW

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Atomic Power Stations

SOBER VIEWS OF A NEW FUEL

ALTHOUGH informed opinion does not lend support to the popular idea that cheap power may be obtainable shortly through direct application of the principle of nuclear fission, the prospects of major developments on other lines seem favourable. The sober engineering approach is the well-established one of converting the heat energy of fuel into kilowatt-hours. Many years are likely to elapse between a scientific discovery of the first order and its technical application, as in the case of Faraday's discovery of electro-magnetic induction and the rating of 6,000 kW given to the experimental atomic pile at Harwell is without relevance to electricity generation.

Proper Perspective

The application of nuclear fission to the production of electricity was given its proper perspective in a lecture recently delivered to the Electrical Power Engineers' Association (London Technical Group) which was reported in our issue of 20th April. In this Mr. R. V. Moore referred to nuclear fission as providing not a new form of energy but a new fuel. He made evident the nature and magnitude of the problems to be solved before this fuel can be used on a commercial scale.

Present indications are that fissile material, one ton of which contains as much heat energy as three million tons of coal, will be "burned" in reactor blocks, which with their pumped coolant systems and heat exchangers will take the place of boilers. Thence onwards normal power station practice will be followed. Temperatures are as yet not high enough to allow of efficient operation, since aluminium with its low melting point is the only common metal usable in reactors that does not absorb neutrons and so break the chain reaction, thus stopping the process. Much metallurgical research will have to be undertaken to discover the suitability of metals now almost unknown to engineers. Important among many other problems is that of how to dispose of waste products, which—although they are small in bulk—are highly radioactive.

Design of Reactors

Enough is known of fundamental principles to enable small prototype reactors to be designed for relatively low temperatures. It is now a question of selecting those most promising for future developments, such as the conversion of the abundant isotope of natural uranium and the metal thorium to a fissile material with the possibility

that the yield of new fuel from these sources will exceed the consumption of the older types of fuel.

It is too early yet to estimate the overall cost of generation. Reactors will almost certainly cost more than boilers, but the running cost, as Mr. Moore showed, should be very much less, conditions being analogous to some extent to those obtaining with water power. Economic comparisons with present methods of generation are mainly of academic interest, however. The position has to be considered in the light of an annual growth in the demand for electricity that is accompanied by a depletion in reserves of fuel. Coal will no doubt continue to be required for many other purposes which now take some 85 per cent of the total mined. Nuclear fuel will do more than provide a possibly cheaper source of electricity. No other means is at present manifest whereby the electrical needs of a perhaps not very remote future can be met at any cost.

POWER CUT REMEDIES

The recent severe power cuts have sprung from a combination of causes which are likely to recur until the generating plant position improves very substantially. Domestic consumers have been the principal sufferers, which is bad enough, but there has also been a great deal of industrial interruption. Comments on the cuts were made at last week's meeting of the London and South Eastern Regional Board for Industry when it was considered that the electricity supply industry should be rated next in importance to the coal industry in the allocation of materials, particularly steel. Another suggestion made was that electrical maintenance men from industrial establishments should be encouraged to assist the B.E.A. at week-ends to relieve the Authority's staffs. This might be a way of speeding-up overhauls but we can see possible objections from the unions, apart from other considerations.

RAW MATERIALS

Mr. Strauss's qualified optimism in the House of Commons debate on raw materials last week seems to have some backing from Mr. Charles E. Wilson, the American Director of Defence Mobilization, who has had talks with members of the Government in London. He said that the responsible American authorities were determined that there should be an equitable distribution of raw materials and machine tools among members of the North Atlantic Treaty Organization for rearmament and other essential purposes. Mr. Wilson refuted the suggestion that the American rearmament programme would be carried out without greatly affecting the standard of living; there would be a decline in that standard in the next two years. It is satisfactory to have Mr. Wilson's assurances on these points and to feel that within the limits imposed by what is actually available in the way of raw materials this country will receive full consideration.

NO ROOM FOR DOUBT

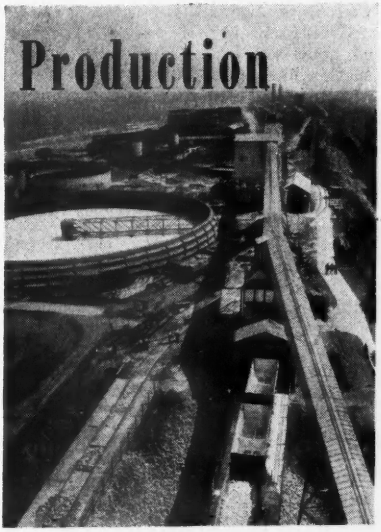
Reasons for disagreement with John Stuart Mill regarding his doubt as to whether mechanical inventions had on balance added to human happiness were advanced by Mr. C. W. N. McGowan in an address last week to the Engineers' Guild. World stability would be greatly strengthened, Mr. McGowan justifiably concluded, by raising the low standards of living found in many undeveloped countries. Improvement would follow a realization by their inhabitants of the value to them of engineering achievement. The implication of this forward-looking view is that opportunities for electrification vastly greater than any that have been open hitherto await engineers having the requisite experience.

THE COBBLER'S LAST

Members of the Institute of Fuel are pre-eminently qualified to deal with technical problems of combustion with due regard to the specific economic aspects of each case. The position of the Institute is strengthened by limiting its activities in this way. This view provided the main theme of Mr. J. F. Ronca's presidential address, in which he repudiated one of the early ambitions of many members to formulate a national fuel policy. So many aspects other than the purely engineering are involved that only the Government of the day can make decisions of this nature in the light of information from all sources. Although Mr. Ronca restricted his comments to the Institution's affairs, they are of application to engineering and scientific matters in general.

Magnesium Production

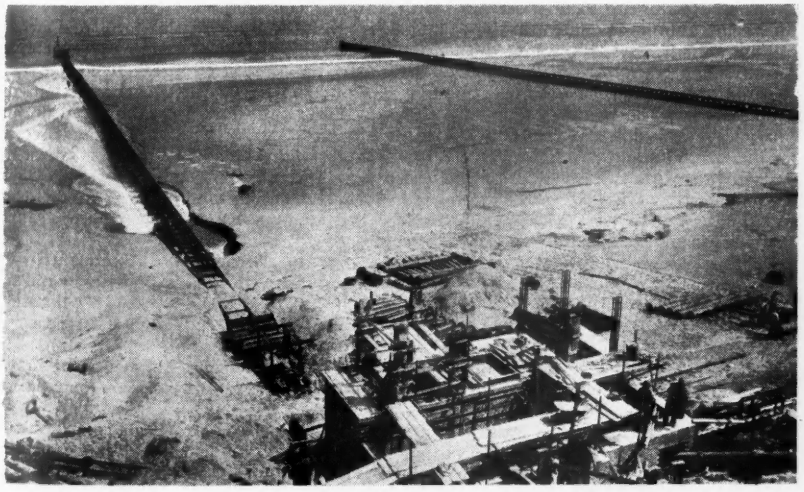
The Sea Water Magnesia Process



THE production of magnesium from sea water magnesia is comparatively a new industry in this country, and broadly there are two classes of the initial product. On the one hand there is the caustic magnesium which is used for the production of magnesium metal for the light alloys industry, while on the other hand there is the dead burnt material which is used largely by refractory manufacturers for the production of bricks used for the linings of steel melting and other high temperature furnaces. It is the latter sea water magnesia process as we have seen it at the Palliser Works, Hartlepool, operated by the British Periclase Co., Ltd., with which we are concerned in this article.

The two essential raw materials are dolomite limestone and sea water, and the process involves mixing the sea water with the limestone after burning the latter to lime. To first trace the flow line from the sea, two jetties which project out from pumping stations at the shore are long enough to permit continuous pumping from

The title illustration gives a general view of the works from the top of the lime kiln; thickener tanks on the left, calcining plant at the rear right. *Below :* **Two long jetties permit continuous pumping from half flood tide to half ebb tide**



each incoming half tide, through the flood and on each outgoing half tide, i.e., about 14 hours per day. There are two intake suction lines, 22in and 18in, on each jetty, and in each case these connect with 375 h.p. and 300 h.p. motor driven pumps in the pump house concerned. The larger pump in each case is a Harland centrifugal unit and the smaller one is a Sulzer deep well pump.

High pressure water lubrication is provided for the Sulzer pumps, and a special pump house for this service provides water at 100 lb/sq in. Considerable condensation difficulties in the main pump houses are overcome by equipping the motors with combined fan and heater units which blow hot air through the motor windings during the shut-down periods.

Erskine Heap " Korndorffer " auto-transformer starting is adopted for the motors. Vacuum priming is employed for all the main pumps, and a 25 h.p. motor driven priming pump is separately housed in a room above the main pump room and is remotely controlled from beach level by B.T.H. automatic push-button star-delta equipment. The priming units are used for priming the main pumps before starting, and they also automatically remove entrained air from the suction vessels associated with the Sulzer pumps as and when required. This is carried out by an Igranic vacuum switch operating the B.T.H. automatic starter.

When starting up from the main pump house the automatic control in the vacuum pump house is first short-circuited, then the priming motor is started up normally by push-button, and when the main pumping is under way the priming pump is automatically shut down. The sandy nature of the ground about the factory results in a very high earth resistivity, and the resultant problem which is particularly prevalent in relation to the pumping stations is overcome by substituting for the normal earth plates a network of 1in by $\frac{1}{8}$in copper tapes, throughout the whole works site, which is linked up to a borehole.

Although for the time being the main sea water pump motors are controlled locally there is a central control room with comprehensive instrumentation and remote control for such aspects as sea water level, water flow, tide gauging and temperature measurement. Perhaps the most important of these functions is the sea level indication at night and other times when actual sea conditions cannot be observed by the eye, for in rough weather the water intake may be uncovered at the lower points of the waves. A compressed air purge system is responsible for these indications. Multi-core p.v.c. tubes, armoured and protected like electric cables, in short, cables without their conductors, are saddled along each jetty and connect the control room apparatus with a perforated " bell " which is normally below sea level. Compressed air in the cable bears on the sea water surface in the " bell," and the resulting variation of pressure gives the level indication required. This is an Electroflo meter system.

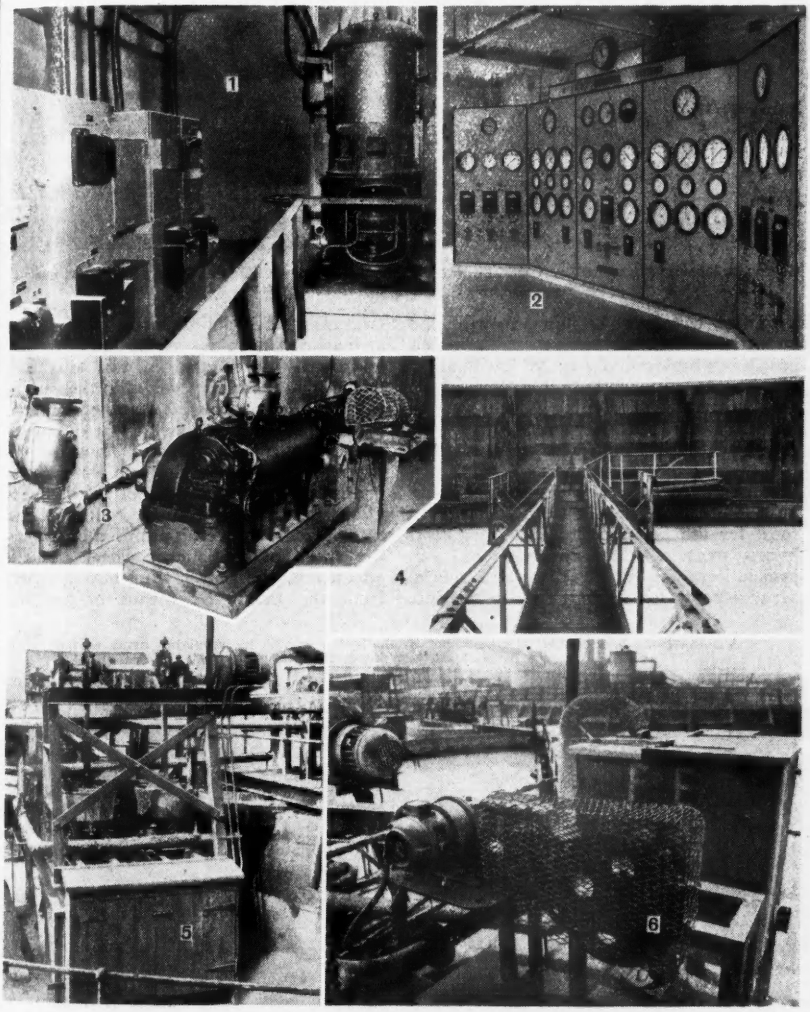
An Electroflo system for measuring the main flow of water employs an oil-mercury manometer. The values of resistance variation are translated into flow terms electrically on to a large indicator integrator and recorder on the control room board. The temperature indications are afforded by Negrette & Zambra instruments and equipment.

Treatment of Sea Water

The main sea water pump houses are at the upper beach level well below the average factory level, and the delivery pipes, cables, etc., between the factory and the pump houses, are carried by substantial girder bridges. The main sea water, which carries with it considerable quantities of sand, is first delivered into a large tank known as a sand trap. The delivery point is about half-way up this tank, and around the top of the tank is a launder which permits the sand to settle out in the tank whilst the clear water overflows into the launder and thence by trough into the 2,000,000 gallon storage tanks. Screens are provided for the launder to arrest the flow of seaweed, etc. The storage tanks are used during the low tide period of each day when the main sea water pumps cannot operate.

Part of the limestone is brought to the factory from the nearby quarries by rail and fed with coke in the required portions into a vertical stack kiln which is served by an electric lift which carries two 17 cwt skips at a time. There are modern motor driven blower and suction equipments associated with this kiln, but perhaps the most important electrical feature is the discharging gear at the bottom of the kiln. A small motor first transmits through V-belt

and cone infinitely variable speed equipment on to a very large ratio enclosed gear from which the end shaft gradually operates an eccentric which moves the discharging trays to and fro. The remaining quantities of the limestone required for operating this process are burnt in kilns at the quarries and the resultant lime is transported by rail to the works hydration plant. The burnt lime from the works kiln is carried by



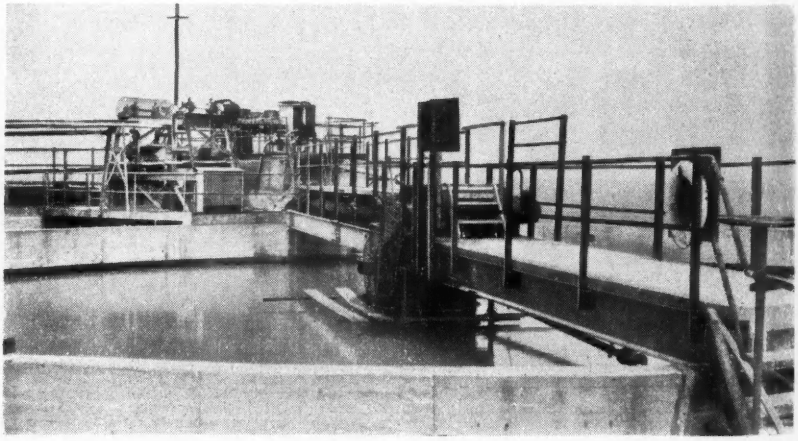
(1) The main pump house motors (300 h.p. deep well shown) are auto-transformer started. (2) There is a central control room for the indication of such aspects as sea water level, water flow, tide gauging and temperature. (3) Perhaps the most interesting electrical feature of the lime kiln is the drive for the discharging trays. (4) The outer end of the thickener arm runs on rollers one of which is motor driven. (5) Special diaphragm reciprocating pumps pull out the sludge from the hydro treater. (6) A bucket wheel (coarse control) dolime feeder is motor driven via a belt and cone type infinitely variable reducing gear (fine control)

The burnt lime is carried from the kiln (*right*) to the processing building by gantry conveyor; part of dolime mixing tanks shown at right of process building

a gantry conveyor to join up with the imported lime at this point to go through a processing building where, by the Knibbs-Sturtevant "dry hydration" process the lime is prepared for mixing with the sea water. Dolime, a slurry made from the processed lime, is mixed in tanks adjacent to the lime processing building.

Water from the sea water storage tanks and dolime from the lime processing plant meet for the first reaction in Dorr-Oliver hydro treaters, large concrete tanks in association with which there are special arrangements for feeding the dolime into the tanks. The dolime is first pumped into an enclosed tank above the hydro treater, and partly submerged in this tank is a bucket wheel which revolves in the vertical plane. The buckets lift definite quantities of the slurry (dolime) which flow away to the hydro treater proper. Thus by prescribing the sizes of the buckets a coarse control of the rate of feed of the dolime is afforded. A second (fine) control of this rate of feed, however, is afforded by varying the speed of the bucket wheel. This is effected in the power transmission system from the motor by means of a Crofts

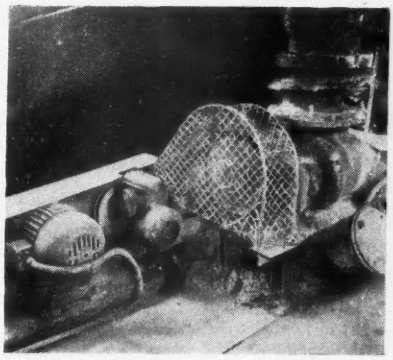
A blanket of heavy sludge is maintained in the hydro treater by revolving arms driven by the centrally disposed motor



infinitely variable V-belt and cone type reducing gear.

In the hydro treater a blanket of heavy sludge is maintained at about 5ft below water level by four horizontally revolving arms through which the sea water is fed into the treater. These arms are driven by a 5 h.p. geared motor centrally disposed on a bridge across the top of the treater, and further transmission to the vertical shaft carrying the arms is via V-belting and an infinitely variable speed gear. The actual overall ratio of this transmission is 1,440 r.p.m. at the motor and only a few r.p.h. at the arms. Special "Dorrco" diaphragm reciprocating pumps are used to pull out the surplus sludge from the hydro treater. Two of these pumps, with adjustable strokes, are driven from an eccentric shaft which is directly coupled to a 3 h.p. geared motor unit. The sludge is passed back to the sea.

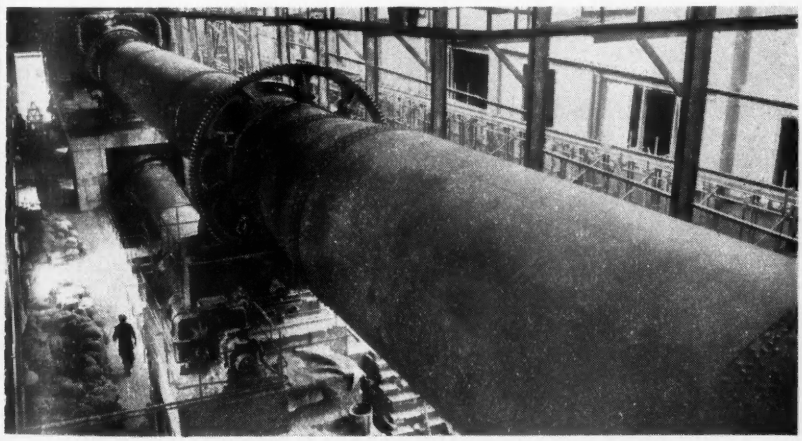
The treated sea water from the first process is passed on to the second process via gravity sand filters and a treated sea water sump, and for this purpose there are in a main site pump house 70 h.p. and 90 h.p. motor driven 3,500 g.p.h. and 4,500 g.p.h. pumps, respectively. In this building there are also fresh-water pumps and back wash pumps for the sand filters. In the second reaction, which employs four smaller concrete tanks, further dolime is added and magnesium hydroxide is precipitated.



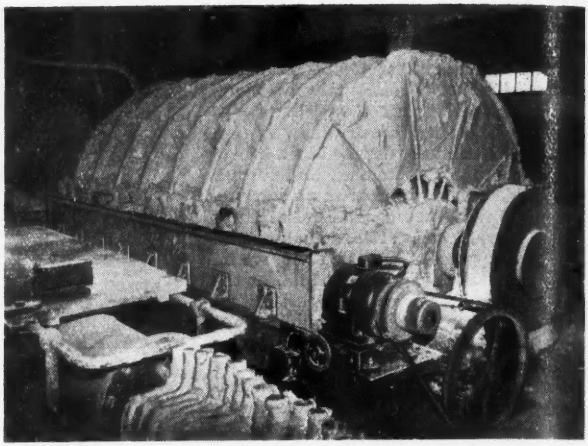
A low speed gear pump feeds the paste into the calcining kiln

The magnesium hydroxide is passed on to one of the four much larger thickener tanks which it enters through ports in a 30in diameter central vertical column. From the centre a radius arm with a walk way at the top and blades at the bottom revolves slowly. At the outer end the revolving arm runs on rollers which bear on a monorail on top of the wall of the tank. One of the rollers constitutes a simple friction transmission to the arm by virtue of a 2½ h.p. motor drive with primary chain transmission, all housed on the arm itself which is 92ft long. At the other end of the arm,

This calcining kiln is 155ft long, is p.f. fired, and is driven by a 37½ h.p. motor



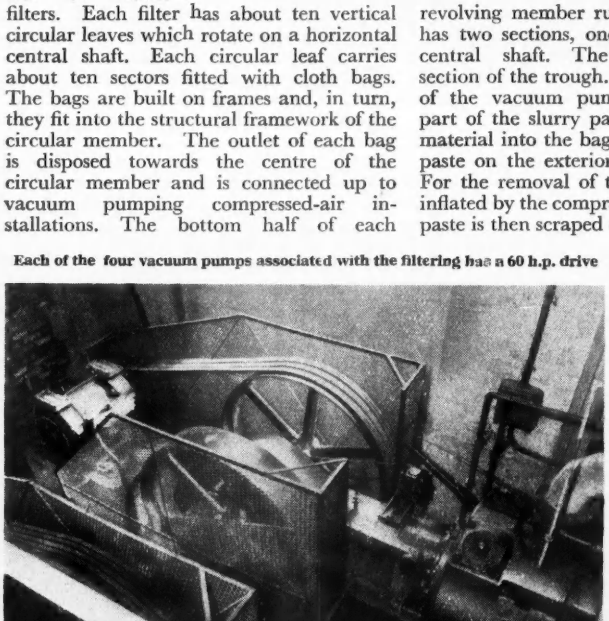
i.e., the tank centre, a slip ring and pick-up arrangement provides the necessary electrical connection to the motor. The blades at the bottom of the arm tend to pass and maintain the solids inwards to and at the centre of the thickener tank, while the water passes outwards to a launder and finally back to the sea.



Paste is built up on the circular bag filter members which revolve at about one revolution in 7½ minutes

From the thickener tanks the slurry is passed on to any of a number of Rovac filters. Each filter has about ten vertical circular leaves which rotate on a horizontal central shaft. Each circular leaf carries about ten sectors fitted with cloth bags. The bags are built on frames and, in turn, they fit into the structural framework of the circular member. The outlet of each bag is disposed towards the centre of the circular member and is connected up to vacuum pumping compressed-air installations. The bottom half of each revolving member runs in a trough which has two sections, one on each side of the central shaft. The slurry enters one section of the trough. Under the influence of the vacuum pump system the liquid part of the slurry passes through the filter material into the bags and away, leaving a paste on the exterior surfaces of the bags. For the removal of the paste the bags are inflated by the compressed-air system. The paste is then scraped off and it falls through the other half-section of the trough on to a conveyor underneath.

Each of the four vacuum pumps associated with the filtering has a 60 h.p. drive



The 3 h.p. drive for each filter has a primary transmission through a belt and cone type infinitely variable speed reduction gear to a Radicon enclosed gear the final shaft of which connects through a pinion gear with the central shaft of the filter. The final speed at the filter shaft is about one revolution in 7½ minutes. There are four pumps in

the vacuum system, each driven by a 60 h.p. B.T.H. motor which is served by an auto-transformer starter.

Finally the paste is calcined in any of four rotary kilns very much like cement calcining kilns. From the filters it is transported by conveyor and elevator to a hopper at the higher (feeding) end of the kiln into which it is pumped by a low speed gear pump to which power is transmitted through an infinitely variable speed reducing gear and a friction plate adaptor.

The kilns are pulverized fuel fired and each is complete with its unit pulverizing system. A very recently installed kiln is 200ft long, 12ft diameter at the back and 8ft 6in diameter at the front. Running at about 0·8 r.p.m., the kiln shell is driven by a C.P. 35 h.p. 960 r.p.m. slip-ring motor with transmission first through an enclosed reducing gear and then through a spur gear on to a rack round the periphery of the shell. After cooling the calcined material goes forward to the bagging department for preparation for despatch as "Britmag," a raw material for refractory-brick manufacture.

We are indebted to the British Periclase Co., Ltd., for permission to visit the works and to publish this article, and to Mr. P. J. Metcalf, engineer to the Research and Development Department, for help in obtaining the information and photographs.

Acoustic Mill-Feed Controller

Ingenious Microphone System

As many readers know, pulverized fuel is processed in tube mills a characteristic of which is that efficiency is almost entirely dependent on the correct amount of raw coal being continuously maintained within the tube. This calls for careful and continuous regulation of the coal feed, a function which in the past could only be performed accurately by a skilled operator who had to rely almost entirely on a highly developed sense of hearing.

Purely mechanical means having failed to provide a satisfactory solution to the problem of automatic regulation, Standard Telephones & Cables, Ltd., has developed a controller which determines the content of the mill from the noise level of the cascading coal and balls in contact with each other and with the walls of the drum. This has proved so effective that it is to be installed in a number of the most modern fuel processing plants.

Essentially it comprises a dustproof microphone placed immediately beneath the drum connected by cable to the main controller which is set up at any desired distance from the tube mill. The output stage of the controller comprises a series of pads for lining-up purposes, an amplifier and a high-pass filter, the function of which is to segregate the significant high-frequency noises, emanating mostly from inside the drum, from the low-frequency noises associated chiefly with the external gearing and drive of the mill itself. The most significant noise frequencies have been found to exist at about 4 kc/s and these give a noise discrimination of 14 db between the full and empty condition of the tube as compared with about 3 db, which is the best discrimination possible when considering the overall noise frequency spectrum of the mill.

The output from the amplifier-filter stage of the controller is used to actuate a sensitive relay adjusted to operate in accordance with fluctuations in noise above and below a set figure corresponding to the optimum amount of coal in the tube. This relay serves to provide, through suitable heat coils and relay trains, a means of altering the speed of the feed motor or, alternatively, for manual control purposes, of actuating a suitable gauge in order to afford a visual indication of the contents of the tube mill.

Acoustic mill-feed controller developed by Standard Telephones & Cables

Electrical Appliance Design

British Standards for Vacuum Cleaners, Kettles and Irons

AMONG the recent publications of the British Standards Institution are three of particular interest to both the public and domestic electrical appliance manufacturers. These relate to electrically operated domestic irons, vacuum cleaners and kettles respectively, for operation on voltages exceeding 30 V a.c. or 50 V d.c., but not exceeding 250 V a.c. or d.c. The primary aim of these specifications is to ensure that the design and construction of the appliances are such as to afford adequate protection to the user, and in this respect they correspond to the safety regulations which are in force in many other countries.

A point of note in the specification for vacuum cleaners (B.S. 1645 : 1951) is the recognition of the principle of "double insulation" as an alternative to earthing, a principle which has already been recognized in the 12th edition of the I.E.E. Wiring Regulations in so far as vacuum cleaners are concerned. In the case of such a double-insulated cleaner it is pointed out that no connections of a radio interference suppressor, if fitted, should be made to exposed metal parts of the appliance.

The Standard includes both design and constructional details and deals with creepage distances and air gaps, soldered connections and terminals, means of connection and earthing facilities, cord anchorage, protection against rusting and the inaccessibility of moving parts. The section on testing covers loading, temperature-rise, switches, cord anchorage, electric strength, insulation resistance and earth continuity.

In the case of kettles, B.S. 1671 : 1951 sets out the minimum requirements for those appliances with metal bodies, for the specified voltages. Apart from dealing with mechanical construction it includes details on heating elements (immersion and clamp-on types), safety devices, means of earthing and connection and internal body finish. It also describes tests for earthing, insulation, loading, life and automatic safety devices as well as a method of measuring leakage current.

The Standard for domestic irons (B.S. 1732 : 1951) deals with both thermostatic and non-thermostatically controlled types and covers constructional details, heating elements, terminal parts and arrangement, flexible cord protection and stands. The tests embrace mechanical shock, loading, insulation, earthing, temperature, cord grip, life and vibration. The appendix describes a method of measuring leakage current.

WARMING PADS AND BLANKETS

Trading Terms and Conditions

AS the outcome of an "open" meeting of manufacturers of electric heating pads and blankets held in April last year under the auspices of the Associated Manufacturers of Domestic Electrical Appliances, work has been completed on a detailed trading code covering these products. The code, which came into operation on 1st April, sets out the terms and conditions applicable to all classes of distributors.

One of the main features is the elimination of the discounts at one time offered to certain classes of users, including the medical profession; these discounts are now restricted to hospital management committees. A novel provision is the introduction of a higher rate of discount to wholesalers during the summer months, to encourage them to stock blankets and pads when sales are low, thus enabling the manufacturer to keep his production flowing.

Detailed quantity terms have been introduced for all classes of retailer recognized by the code, for one of the problems peculiar to the electric blanket and pad industry is that its products are distributed to a large extent through electro-medical channels and through stores, and the quantity terms schedule is applicable to retailers in those trades, in addition to all electrical retailers, including the Electricity Boards. Thirteen manufacturers are so far operating the code.

Domestic Water Heating

Suggested Method for Improved Control

By BAYFORD BENNETT, Associate I.E.E.

THE increasing interest which is being shown by the public in electric water heating is at present due in very large measure to a scarcity of solid fuel rather than any other consideration. From a national fuel point of view, therefore, the installation of an immersion heater is by no means a panacea for the water heating troubles of the average householder. Further, it may be said to be somewhat wasteful of fuel in that, if the fuel-fired boiler operates efficiently, many unnecessary electrical boosts take place when the demand for hot water exceeds a few gallons. So far as is compatible with the saving of fuel, however, it is desirable to maintain the service which has been so long advertised and implemented by electricity supply authorities as the "constant" system.

Eliminating Waste

The generally accepted method of operation is to leave the immersion heater switched on continuously throughout the year, allowing the thermostat to take complete charge. In addition, the solid fuel system is brought into use in the colder weather when the space heating derived therefrom is required. This system of operation provides the optimum hot water service obtainable from the installation compatible with what might be termed good housewifery. Unfortunately, it is somewhat wasteful of electrical energy, but certain modifications could eliminate waste without materially reducing either the temperature or the quantity of hot water available.

If the solid fuel boiler is working efficiently and, say, one half of the water in the storage tank is drawn off, the immersion heater circuit will be closed as soon as enough mixing has taken place to reduce the temperature in the region of the thermostat below its lower limit of tolerance. But we have assumed that the boiler is working well so that an electrical boost in this case is unnecessary.

To avoid this waste of energy a thermostat in series with the one in the storage tank could be placed in the flow pipe. But this expedient can be ruled out immediately on the ground that the flow of water would be seriously restricted and consequently excessive deposits of scale would form in hard water districts. Further, seasonal setting would be required to compensate for varying inlet feed water temperatures. The system would operate at only one given temperature, plus or minus the tolerance of the instrument, which would undoubtedly be unsatisfactory as the variables involved are many. To mention but a few of them, there are feed water temperature, varying boiler output in B.Th.U. per hour due to differing calorific values of the fuels used, combined with erratic stoking and the gradual furring up of pipes, changes of wind and so on.

Although some form of pyrometer adjacent to the fire itself and operating a pair of contacts in series with the thermostat in the storage tank would overcome a number of the foregoing objections, it would not seem to solve the problem completely.

Water Flow and Heat Output

It is suggested, therefore, that an instrument is required to operate on a difference between the temperatures of the water in the flow and return pipes. The rate of flow of water in the boiler circuit is in direct ratio to the output of heat from the boiler, irrespective of any specific temperature reached. As the underlying principle of this suggested method of economy is dependent upon boiler output rather than any other consideration, it is necessary that this fact of water flow in relation to heat output be considered.

To implement this form of control requires something slightly more elaborate

than a normal thermostat. It should be capable of closing a pair of 15 A contacts as the temperatures of the water in the flow and return pipes tend to equilibriate and to open them again when an empirical difference of a given number of degrees is reached. Further, it should differentiate between the temperatures of the water in the pipes rather than the fabric thereof and should be unaffected by ambient temperature.

Although at this stage no figures of performance are available, it might well prove that when a solid fuel boiler is being used in conjunction with a standard type of immersion heater installation a saving in electrical energy of between 10 and 30 per cent could be achieved.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Electrical Vector Diagrams

I FEAR I must ask for a little more space to comment upon Mr. Edgley's second letter on this subject (27th April). Some of what I have to say merely agrees with Mr. Scroggie's article, but it is necessary to repeat one or two points in order to clear up certain misapprehensions. First, I am glad that my interpretation of Mr. Edgley's use of single subscripts was correct, despite the printing difficulties.

In commenting upon the last sentence in my previous letter, Mr. Edgley seeks to make difficulties for his opponents which they do not experience. Referring to Fig. 7 of Mr. Scroggie's article, for example (9th February, p. 271), Mr. Edgley would write:

$$V_{ba} = V_{bc} + V_{cd} + V_{de} + V_{ea}$$

whereas I prefer:

$$V_{ab} = V_{ae} + V_{ed} + V_{dc} + V_{cb}$$

and as I stated previously, the "cancellation" process can be applied equally to either. As Mr. Scroggie pointed out in his article, the first corresponds to the voltage drop concept, and the second to the voltage rise. The difficulty with the former occurs when the generator (a–b) is reached. The "fall conventionists" do not deny that an e.m.f. is a rise of potential, so that their $E_{ba} = -V_{ba}$. This requires two kinds of voltage, rise and fall, and again I ask, why?

Mr. Edgley's use of double subscripts for identifying current paths is quite another matter. He used I_{ab} to mean, not the current flowing from a to b (path unknown, as Mr. Scroggie's letter pointed out) but the component of the a phase current flowing in the b phase. While I am not quite happy about this particular application, the notation is widely used, for example in symmetrical components, where I_a, I_a, I_{ao} are the positive, negative, and zero sequence components of the a phase current. In general this use of double subscripts is not ambiguous, and generates no heat. No one has suggested that the order of these subscripts should be reversed.

I decline to follow Mr. Edgley's red herring of a hypothetical and seemingly complicated protective gear problem, but I assure him that I have occasion to deal with comparable problems from time to time, and find no difficulty in applying the voltage rise convention.

Finally, I agree warmly with Mr. Edgley's plea for consistency, and the definition of the convention used by individual authors until standardization (of voltage rise, of course!) is achieved.

Harlesden, N.W.10. G. LYON.

Installation Costs

MY tentative ranging shots fired at Mr. Milne, sen., appear to have provoked return salvoes of considerable proportions. Is it outraged innocence that replies, or is it a case of the truth that stings?

Mr. Milne should read my letter again and note that I do not suggest he ignores "wage increases and other increased costs." What I did say was that in my experience the tradesman's rise is passed on to the customer, plus a little extra for the contractor's pocket.

I don't think that Mr. Worboys is still

making the same profit per hour out of his men that he was, say, ten years ago. He surely will not blame increased costs for this—they are covered by material charges and overheads, or should be. I am not in business for myself because I just could not stand the worry of wondering if those piratical electricians intended to filch more of my profits.

I am fully aware that "we are all in this together" as Mr. Worboys so plaintively remarks, and with this in mind I am studying an approved course in advanced economics and also attending night school for a National Certificate in Electrical Engineering with the object of being a better man at my job. I can only hope that Mr. Milne's gloomy prognostications will not materialize before I have my A.M.I.E.E.

PHILLIP R. S. MAY,
Canterbury. *Journeyman Electrician.*

Economic Loading

THE suggestion put forward by Mr. J. G. Hebden in his letter (27th April) is certainly ingenious, but fails to take full account of the facts. The object of my article was to point out that "the complex trio of fixed losses and economic and m.c.r. incremental rates" could not be rigidly employed due to purely mechanical limitations. It is, however, important to realize the fundamentals on which any attempt at accurate loading of generating plant should be based.

The fixed losses cannot be ignored since they are essential to the establishment of an economic running combination, and Mr. Hebden's assumption that running at 60 per cent of m.c.r. could be justified for a considerable amount of plant is obviously not tenable. When a given machine is on load it should only be reduced below economic rating if such a reduction is justified by its incremental cost between minimum load and economic rating. Since this incremental rate usually approximates to a straight line, it follows that the machine, once reduced below economic rating, could very soon be taken off load unless required for the provision of spare capacity.

The method used in practice during the daytime employs this principle and is, as described in my article, composed of the cost at economic rating and the incremental cost between economic and maximum continuous ratings for each machine. Between midnight and 6 a.m. a more accurate form of loading, excluding the fixed losses, is employed.

I would not support Mr. Hebden's contention that a weighted average of the ratio of economic to maximum continuous ratings of all machines could be used in practice. It should also be realized that existing plant shortages and load shedding do not materially affect the question of economic loading for more than about 20 per cent of the total running time. It is, therefore, essential that every effort should be made to achieve the cheapest possible generating cost by the accurate disposition of load.

The method described in my article as being used in practice was devised for an area containing more than 100 generating sets with widely different performance and fuel cost. It has been found by a process of experience and improvement and, in my view, it cannot undergo any great refinements until considerably more accurate information concerning the machines, boilers and fuel is available, and some form of mechanical analysis has been developed.

Birmingham, 28. F. L. TOMBS.

Hot-plate Interchangeability

IT seems that the E.D.A. specification for interchangeability of cooker hot-plates is again in danger of going astray. When using standard E.D.A. cradles with single-circuit plates for "Simmerstat" control there seems to be no uniformity in the way two pins are used for the connections. The result is that hot-plates of different makes are not interchangeable because the current-carrying pins are in different positions.

ICH DIEN.

Raw Materials Survey

THE eighteenth in the raw materials surveys issued by the Purchasing Officers' Association is entitled "Raw Materials of the Refractories Industry." This series is intended primarily to cover the syllabus of the Association's final examination subject "Raw Materials (Economic and Geographical Survey)," but there is also much factual information for anyone interested in the study of world sources of supply of materials. The latest booklet is obtainable from the Association at Wardrobe Court, 146A, Queen Victoria Street, London, E.C.4, price 2s 6d.

VIEWS on the NEWS

By REFLECTOR

IT seems that Electricity Boards' development programmes are likely to be very severely curtailed as a result of the cuts in capital expenditure in 1951–52 which are expected to be announced shortly. Referring to this subject at last week's meeting of the Eastern Electricity Consultative Council, Alderman W. J. Bennett, the chairman, explained that his area would be particularly badly hit because of its rural character which necessitated considerable expenditure on extensions and also because work on the new towns meant that less money would be available in other directions. He feared that rural development was going to receive a very severe setback. This is a great pity, I think, for while rearmament will tend to attract manpower from agriculture, the latter industry will be deprived of the means of modernization and labour-saving.

* * *

From time to time I have heard older engineers refer to the breed of millwrights of the kind who were largely instrumental in founding the Institution of Engineers-in-Charge more than half a century ago. They have expressed gratitude not only for practical instruction but also for the homely wisdom imparted them in fitting if sometimes caustic terms. An example was given at the Institution's annual dinner last week by Mr. H. W. Swann, who recalled the implied criticism he received when as an apprentice he complained of the cold, as was not unnatural, considering the primitive heating of workshops in those days: "You can keep warm, young man, if you work harder." This story, it seems to me, has an allegorical character, with a wider bearing.

* * *

Some Indian electrical contractors appear to have settled the question of the uprating of electric motors without going into the various factors which call for consideration. At a recent conference in India a representative of one of the electricity supply companies said that his company had to deal with the practice of wiring contractors of removing the name plates from motors and substituting others bearing different h.p. ratings. He asked for advice. Some speakers said that a temperature test was the only method of assessment; others advocated a properly conducted brake test. The real solution appears to be the employment of properly conducted contractors.

* * *

Some amusing effects are obtained from the "stereophonic" installation in the "Telekinema" at the South Bank Exhibition. On a recent visit I heard a little staccato tune start from the screen, travel down one side of the hall, pass round the back and return up the other side to the screen. It was a kind of "motor-cycle" effect, but musical. Excellent results were also obtained from the stereoscopic films—much better than some I saw a few years ago. The projected television was much better than I anticipated. Some distortion at the edges is difficult to avoid but its amount was comparatively small.

* * *

There have been frequent complaints from rural communities that although the grid passes over their heads they are unable to secure a supply of electricity. I read in the *Sunday Independent* (Dublin) that the residents of Parteen parish, in which the Shannon power station is situated, have been unable to get a supply. A correspondent says:—

> "We hear the turbines humming and we see the brilliant lights of the power house, but we have to illuminate our homes with candles and paraffin lamps."

The Shannon Scheme, like the grid, in this country has been in operation for over twenty years.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Faraday Medal for 1951 was presented to **Mr. T. L. Eckersley**, B.A., B.Sc., Ph.D., F.R.S., M.I.E.E., at a private ceremony held at the Chelmsford Works of Marconi's Wireless Telegraph Co., Ltd., on 1st May. Owing to illness Dr. Eckersley was unable to attend a London function and, such is the esteem in which he is held by brother members, the unprecedented step was taken of holding the ceremony near his home. The medal was handed to Dr. Eckersley by Sir Archibald Gill, B.Sc.(Eng.), President of the I.E.E., who said that the Council of the Institution had awarded the medal to Dr. Eckersley for his achievements in the field of radio research and, in particular, for his outstanding contributions to the theory and practice of radio-wave propagation. The President was accompanied by Prof. E. B. Moullin, M.A., Sc.D., and Sir Noel Ashbridge, B.Sc.(Eng.), past-presidents of the Institution, and Mr. W. K. Brasher, M.A., secretary. Mrs. Eckersley and several of Dr. Eckersley's personal friends were present, together with Sir George Nelson, chairman of Marconi's, and a number of Dr. Eckersley's former colleagues.

As we have already reported **Mr. T. F. Lister**, chairman and managing director, Hackbridge & Hewittic Electric Co., Ltd.,

Mr. T. F. Lister

Mr. I. R. Cox

has been elected chairman of the British Electrical and Allied Manufacturers' Association for 1951-52 and **Mr. I. R. Cox**, D.S.O., managing director, Metropolitan-Vickers Electrical Co., Ltd., has been re-elected vice-chairman of the Association.

Mr. Lister was born in Yorkshire and educated at the Halifax Technical School. After three years with a small engineering firm in Yorkshire, he joined Ferranti, Ltd., in 1901 and, after a few months at Hollinwood, was transferred to the London Office Contracts Department. When this office was closed down in 1904 he joined the General Electric Co., Ltd. In 1905 Mr. Lister went to the British Westinghouse Co. (now Metropolitan-Vickers), where he remained for twenty years. During the 1914-18 war he had charge of the Deep-Sea Mining and Magneto Departments. After the war, he was appointed superintendent of a new Main Production Department covering the whole of the Trafford Park Works, a position which he occupied until 1925, when he left Trafford Park to take up the position of manager of the Hackbridge Electric Co. In 1926 he was appointed manager also of the Hewittic Electric Co., becoming director of both companies in 1931, and managing director of the companies and the New Switchgear Construction Co., Ltd., in 1944. He was appointed chairman and managing director in 1946 and the following year took up a similar position with the amalgamated group the Hackbridge & Hewittic Electric Co., Ltd.

Mr. I. R. Cox joined the British Westinghouse Co. as a college apprentice, and in 1913 was appointed assistant turbine engineer. He served throughout the 1914-18 war with the Royal Artillery, in which he ultimately commanded a brigade; he retired with the rank of major. He was twice mentioned in despatches and was decorated with the D.S.O. and the Croix de Guerre.

On returning to the Trafford Park Works in 1919, Mr. Cox worked as turbine engineer until 1927, when he went to Russia as chief mechanical engineer for the company, in charge of turbine work. He afterwards visited Australia, the United States of America and Turkey on the company's business. In 1941 he was appointed joint managing director of the Metropolitan-Vickers Electrical Export Co., Ltd., becoming managing director in 1944. In the same year he was elected to the board of the Metropolitan-Vickers Electrical Co., Ltd., appointed general sales manager in 1946 and shortly afterwards managing director of the company. He is also deputy-chairman of the Metropolitan-Vickers Electrical Export Co., chairman of the

Edison Swan Electric Co., Ltd., and Metro-Cutanit, Ltd., and director of Associated Electrical Industries, Ltd., the British Thomson-Houston Co., Ltd., Metropolitan-Vickers-GRS, Ltd., and Sunvic Controls, Ltd.

Mr. A. L. G. Lindley, M.I.Mech.E., has succeeded Mr. F. Lonsdale as general manager of Fraser & Chalmers Engineering Works, Erith, of the General Electric Co., Ltd. Mr. Lindley joined Fraser & Chalmers in 1918 as an apprentice and after spending some years as an assistant engineer in the mining department was appointed in 1933 chief engineer to the British General Electric Co., Ltd., in South Africa. He was later appointed assistant general manager and a director of this company.

Mr. A. L. G. Lindley

Mr. C. Buckle, A.M.I.E.E., has been appointed engineer-in-charge of the television transmitting station now being built at Holme Moss, near Huddersfield. Mr. Buckle joined the staff of the Alexandra Palace television station in 1938. In 1939 he was transferred to the transmitter department, becoming successively engineer-in-charge of the stations at Blackburn and Middlesbrough. He was appointed to the staff of the Engineering Training Department in 1944 as an instructor on transmitters. Mr. Buckle's assistant at Holme Moss will be **Mr. J. P. Broadbent,** who is at present a senior engineer at the Droitwich transmitting station.

The Brush Electrical Engineering Co., Ltd., has awarded the Brush scholarship for 1951, valued at £150 per annum for three to four years, to **Mr. Derek Joyce,** an engineering student apprentice. Mr. Joyce, who is nineteen, will join Nottingham University in October. His special interest is turbines.

Mr. K. H. R. Lauben has been appointed a director of E.M.I. Sales & Service, Ltd. Mr. Lauben joined the Columbia Graphophone Co., Ltd., in 1915 and eventually became manager of the Distribution Division of E.M.I. Sales & Service, Ltd.

Mr. W. M. Maynard, who has been appointed deputy Sub-Area manager of the Northmet Sub-Area of the Eastern Electricity Board, was educated at King Edward VI School, Southampton, and received his technical training at Faraday House and with the Brush Electrical Engineering Co., Ltd. He served with the R.F.C. during the 1914-18 war, and in 1920 joined the Northmet Power Co. as assistant engineer, Enfield district, subsequently becoming district superintendent. Since vesting day he has been southern area superintendent in the Northmet Sub-Area.

Mr. Frank Nicholls, who from 1939 to 1948 was Leeds city electrical engineer, retired last week-end from the managership of the No. 4 (Leeds) Sub-Area of the Yorkshire Electricity Board. He was presented by the Leeds staff with a television set, and tributes to his services were paid by Mr. H. Hurworth (No. 4 Sub-Area chief engineer), Mr. F. Barrell (construction engineer, Yorkshire Division), and Miss M. Arnold.

Mr. H. Walker and **Mr. W. Walker,** twin brothers, of Bramley, Leeds, are retiring shortly from the staff of the Whitehall Road Electricity Works, Leeds, after a combined service of nearly 100 years. For some years Mr. H. Walker has been power station superintendent and his brother stores superintendent.

Dr. C. F. Bareford, head of the Mullard Electronic Research Laboratory, has been appointed a director of Mullard Equipment, Ltd.

Mr. A. R. Northover, director and works manager, Hoover (Washing Machines), Ltd., has been re-elected president of the South Wales & Monmouthshire Section of the Institution of Production Engineers.

Mr. J. G. G. Noble is joining Argosy Radiovision Ltd., as sales director.

The first Council meeting of the **Exeter Electric Club** was held recently and the following officers were appointed :—President, Mr. H. Peters; vice-president, Mr. L. W. Cornish; hon. secretary, Mr. G. S. Mogridge; hon. treasurer, Mr. H. Bicker.

Mr. D. Hooper, after fifteen years as contracts engineer with Blackburn Starling, Ltd., Nottingham, has now joined D. Hooper & Co., electrical engineers, 44, Glasshouse Street, Nottingham, a subsidiary of Professional & Technical Services (Nottm.), Ltd.

Mr. A. H. Langford, M.Inst.P.E., director and general manager of Heenan & Froude, Ltd., has been appointed a director of their subsidiary company, the Morton Machine Co., Ltd., Wishaw, Scotland.

Sir Charles Colston, C.B.E., M.C., D.C.M., chairman and managing director of Hoover, Ltd., has joined the board of the American organization, the Hoover Co. of North Canton, Ohio.

The **London Electricity Music Society** (London Electricity Board and London Division, B.E.A.) maintained its high standard in a choral and orchestral concert given at the Kingsway Hall on 1st May. It was a very full

programme, the main items in which were Beethoven's Fifth Symphony, and Mendelssohn's "Hear My Prayer" and an excerpt from Haydn's *Creation* for soprano, chorus, orchestra and organ. The soloist in the first case was Betty Walker, who was in good voice, and in "The Heavens are Telling" Margaret Wilby acquitted herself well. The chorus (under Douglas Sharpe) gave a very pleasing performance in these excerpts and in a number of part songs and the orchestra (leader, Albert Pooley) was well balanced and adept. The conductors were Kenneth Thomas and Douglas Sharpe (who also acted as organist).

At the recent annual "Wylex" dance (**George H. Scholes & Co., Ltd.**) at the Plaza Ballroom, Manchester, four members of the staff were presented with gold watches to commemorate the completion of twenty-one years' service with the company.

Mr. **I. Jeffcott**, L.R.I.B.A., has been appointed by the Radio Industry Council as consulting architect for the Radio Show to be held at Earls Court from 29th August to 8th September next. Exhibitors are free as before to have stands to their own designs, but Mr. Jeffcott will advise the organizers on special features, signposting and compliance with official regulations and will supervise constructional contracts. Other R.I.C. appointments for the Radio Show are **Mr. D. A. Bates**, as exhibition officer, to help in the general organizational work carried out by the R.I.C. secretariat, and **Mr. H. J. Dyer**, as programme officer, to plan and present the sound and television programmes within the exhibition.

At the recent annual meeting of the Dumfries and Galloway Electrical Society **Mr. S. H. Money**, Assoc.I.E.E., engineer, Dumfries and Galloway Sub-Area of the S.W. Scotland Electricity Board, was elected president for 1951-52.

To commemorate members of the staff of the former **North Wales Power Co.**, and its associated companies who gave their lives in the last war, a memorial plaque was unveiled at Rhostyllen on 2nd May. The ceremony was performed by Air Commodore C. E. Benson, C.B.E., D.S.O. (chairman of the former British Power and Light Corporation) at the offices of No. 4 Sub-Area of the Merseyside and North Wales Electricity Board, which until 1948 were the headquarters of the North Wales Power Co. The plaque, which is in the entrance hall, records the names of twenty-five members of the staff who gave their lives. Amongst the company present were Brigadier-General Legge, C.B.E., D.S.O., Mr. R. Nelson, Mr. G. Wansborough, Lieutenant-Colonel Cortez-Leigh, Major C. Bollam, M.C., Mr. G. K. Paton (former directors of the companies), Mr. J. Rankin, O.B.E. (former director and general manager of the companies, and now secretary to the Board), Messrs. G. T. Garwood, H. S. Prowse, W. Wade and E. J. Cook (former engineers and managers of the associated companies), Mr. W. J. Rowland, and Mr. R. N. Pegg (No. 4 Sub-Area manager). After the unveiling the memorial was dedicated by the Rev. S. Gore-Rees, Vicar of Esculsham, and the Rev. Canon R. Davies, Vicar of Wrexham.

OBITUARY

Mr. R. J. Morgan.—The death has occurred at East Boldon, Co. Durham, at the age of seventy-four, of Mr. Roderick John Morgan, managing director and founder of the Tyne and Wear Electrical Co., Ltd.

WILLS

Mr. J. F. Simpson, M.I.E.E., M.I.Mech.E., formerly borough electrical engineer of Preston, who died on 2nd January last, left £3,439 gross (£3,364 net).

Mr. E. J. Ivison, M.I.E.E., of Bognor Regis, Sussex, formerly G.P.O. staff engineer, London, who died on 23rd December last, left £3,499 gross (£2,448 net).

Mr. Francis Lydall, B.A., B.Sc., M.I.E.E., a partner in Merz & McLellan, who died on 15th August last, left estate "so far as at present can be ascertained" valued at £50,906 gross (£49,481 net).

Mr. C. E. Vines, managing director of the Advance Lamp Co., Ltd., electrical wholesalers, Birkenhead, who died on 8th November last, left £8,110 gross (£4,682 net).

Mr. G. Grainger, M.I.E.E., chief works engineer of J. A. Crabtree and Co., Ltd., Walsall, who died on 13th November last, left £2,762 gross (£2,350 net).

Mr. F. G. Ticehurst, A.M.I.E.E., for many years a member of the staff of the British Electrical & Allied Manufacturers' Association, who died on 28th December last, left £6,610 gross (£5,729 net).

Mr. H. Fildes, formerly sales manager in the Northern Area organization of the Hotpoint Electric Appliance Co., Ltd., who died on 22nd December last, intestate, left £1,786 gross (£1,660 net).

Mr. P. H. Neuville, test superintendent to the Metropolitan Electric Cable & Construction Co., Ltd., who died on 20th November last, left £4,332 gross (£4,241 net).

I.E.E. Annual Report

COPIES of the annual report of the Council of the Institution of Electrical Engineers for the 1950-51 session, and of the accounts for the year ended 31st December, 1950, to be presented at the annual general meeting on 17th May, can be obtained by members on application to the secretary of the Institution.

Industry and the House

The Raw Materials Debate

By F. J. ERROLL, M.A., A.M.I.E.E., M.P.

INEVITABLY the debate on the supply and distribution of raw materials last week was a political occasion. As the leading article in the *Electrical Review* of 4th May implied, it is not easy to discuss material shortages to-day without bringing in some element of party politics.

Early in the previous week two Cabinet Ministers and one junior Minister had resigned from the Government on the grounds, amongst other factors, that the rearmament programme could not be proceeded with on its proclaimed scale because of insufficient raw materials. Mr. Bevan had gone so far as to say that the £4,700 million programme for the next three years was "already dead." Mr. Harold Wilson, as one of the Ministers primarily responsible for getting the raw materials, had been more moderate in tone, but his resignation speech showed plainly that he felt the rearmament programme could not go through as planned. Accordingly the Opposition tabled a motion: "That this House learns with anxiety that the rearmament programme . . . was based on estimates of defence production which were not accepted by the Ministers principally concerned."

American Stockpiling

Mr. Anthony Eden, in opening the debate, appealed to the Government to reveal the true position. As regarded American stockpiling he showed that it had fallen off very considerably—and some important non-ferrous metals were not being bought at all just now. "The truth is," he said, "that the United States built up its stocks of raw materials while we were accumulating gold." He hoped that we would not be too defeatist, however. The British Commonwealth and Empire had collectively a very important part of the world's raw materials within their territories. "Therefore we are not in such a bad bargaining position, and there is no need to talk as if all the raw materials of the world belonged exclusively to the United States. They do not."

Mr. Strauss started his speech by saying that all the Ministers concerned accepted completely the defence production estimates. The Government realized the uncertainties involved in carrying out such a large programme, and he shared the anxieties of the Ministers who had resigned. The Government had been successful with its purchases of machine tools, he continued. Already 8,000 had been bought, and orders placed in the U.S.A. for a further 6,500.

New Department

Turning to raw materials, he said that he realized that the situation had deteriorated in some respects, but he hoped that was only temporary. The appointment of Mr. Stokes as Lord Privy Seal to run a new Department for procuring and distributing raw materials would ensure adequate supplies for this country and a proper supervision over distribution where shortages persisted. Detailed allocation would still remain with the Department responsible. In particular the new Department would take over the distribution of sulphuric acid and the expansion of capacity to make acid from materials other than crude sulphur. One of the most important functions of the new Department would be in connection with international negotiations for raw materials.

The subsequent progress of the debate was chiefly remarkable for the alternating attacks on and defences of the Ministers who had resigned. Mr. Hudson's winding-up speech underlined the doubts which remained in the minds of the Opposition. He did not think that rearmament orders were being placed with sufficient speed, and in the aircraft industry "there is no longer any sense of urgency."

Mr. Shinwell, the Minister of Defence, wound up for the Government. He maintained that raw materials were being allo-

cated fairly by an interdepartmental committee. Labour difficulties, particularly in the North, were having a bad effect on the programme. It was affecting ships for the Navy, and had reduced the output of tanks. He was looking for the full co-operation of the trade unions. The Government considered that the 1951/52 programme would be broadly fulfilled at an estimated cost of £1,300 million. Delays in placing orders had not affected the programme. He accepted the interference to the civilian economy which must result. Mr. Shinwell's final remarks were lost in a general uproar, and in the division which followed the Government won through with a majority of 13—large for these days. Mr. Bevan, Mr. Wilson and Mr. Freeman all voted with the Government.

The publication of the Finance Bill revealed several unpleasant surprises not mentioned by the Chancellor in his Budget speech. These include severe restrictions on companies going abroad, and powers to compel banks to inform the Inland Revenue of certain receipts of interest-free payments by their clients. Directors, too, are once more presumed guilty of certain offences unless they can prove their innocence.

In the Sea Fish Industry Bill the clause presuming directors and certain company officers guilty has been taken out by the Lords who offer the Commons an amendment reversing the onus of proof to conform with the established tradition of British justice that a man is innocent until he is proved guilty. A Private Member's Bill seeks to make a similar change to twelve post-war Acts at present containing the same obnoxious provision. Directors and company officers may be surprised to learn from the schedule how they have been singled out as guilty men who would have to prove their individual innocence if their company had committed an offence.

PARLIAMENTARY NEWS

From Our Special Reporter

IN the House of Commons last week Mr. Janner asked the Postmaster-General when the plans were going to be announced for nation-wide broadcasting coverage by the very-high-frequency method.

Mr. Ness Edwards said that B.B.C. proposals for a frequency-modulated v.h.f. broadcasting system were being examined. Those far reaching proposals must be carefully considered and it was much too early for him to make any announcement about them.

Mr. Janner asked if the Postmaster-General was aware that Sir Noel Ashbridge had said there was no reason why this system should not be introduced, and that it was badly needed in view of the serious deterioration on the medium wave band because of overcrowding. Would the Postmaster-General go into the matter as speedily as he could?

Mr. Ness Edwards replied that he was going into the matter as speedily as he could, but what was involved was a question of capital investment, and that was a question which was not so easily settled.

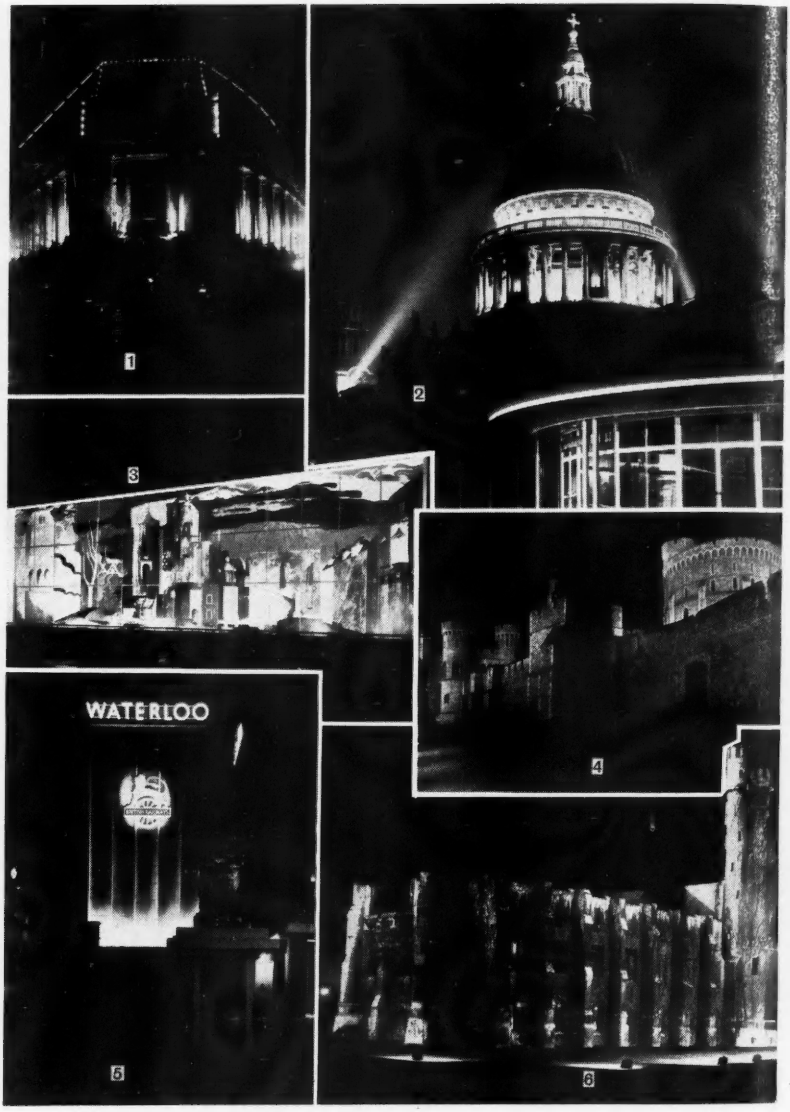
Replying to Mr. Hugh Fraser, Mr. Ness Edwards said that experiments had been completed and there was a report on them. There was the Television Advisory Committee which had to be consulted, and he would await its report about the type of modulation which should be employed, whether frequency modulation or amplitude modulation only should be adopted, or whether there should be a mixture of both.

Sulphur Supplies

The President of the Board of Trade, Sir Hartley Shawcross, informed Mr. H. Price that the possibility of extracting crude sulphur from pyrites was examined by the Board of Trade in 1948, but it was found that the economic use of both pyrites and calcium sulphate was not for the purpose of extracting sulphur but as a substitute for sulphur in the manufacture of sulphuric acid. Plants had been in operation for this purpose for some time and during the past two years every effort had been made to increase their capacity. No schemes had been submitted to the Board of Trade for the production of pure sulphur from either calcium sulphate or pyrites.

Exports to China

During the debate on Monday on exports to China Sir Hartley Shawcross, President of the Board of Trade, said that in the first three months of this year electrical goods and apparatus valued at £163,000 went to China from this country. The principal items were insulated wires and cables (£64,000) and electro-medical apparatus (£30,000). In addition electrical generators without prime movers to the value of £12,000 were supplied.



Some of the Festival Illuminations

1.—Australia House, London. 2.—St. Paul's Cathedral. 3.—Mural painting, South Bank Exhibition (*G.E.C.*). 4.—Windsor Castle (*B.T.H.*). 5.—North side of Waterloo Station (*G.E.C.*). 6.—Middle Temple Library.

Ulster Transport Workshops

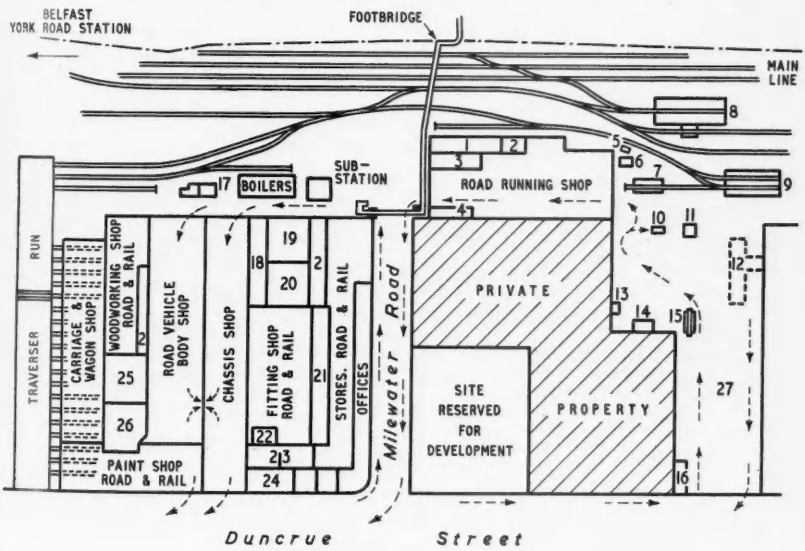
Co-ordinated Service for Road and Rail

By F. GEOFFREY MARSHALL, A.M.I.E.E.*

WHEN the Ulster Transport Authority was constituted under the Transport Act (Northern Ireland) 1948 it acquired the undertakings previously operated by the Northern Ireland Road Transport Board, Northern Counties Committee Railway (formerly part of the L.M.S. Railway) and the Belfast and County Down Railway. Late in 1948 work on a scheme for concentrating road/rail mechanical and electrical engineering and servicing facilities was commenced and the workshops, now almost completed, extend over an area of some 15 acres, on which buildings have been erected with a coverage of 5½ acres. The plan below shows the layout of the area; the only structures existing before building commenced were the locomotive running shed and coaling plant as seen in the upper right-hand corner of the plan.

The main factory is divided laterally with the rail carriage and wagon bay at the left-hand side, the rolling stock being fed into it by means of a 45 h.p. electric traverser equipped with an electric capstan, and in the centre the main body and chassis shops dealing exclusively with road vehicles. The majority of the shops, including woodworking, paint, fitting, machine, electrical and stores are concerned with both road and rail operation.

* Electrical and Signal Engineer, Ulster Transport Authority



Plan of the Belfast road-rail workshops

1. Battery shop. 2. Store. 3. Tyre shop. 4. Office. 5. Diesel rail fuelling point. 6. Breakdown and cleaning. 7. Engine weighbridge. 8. Locomotive running shed. 9. Diesel railcar running shed. 10 and 11. Vehicle mechanical washing. 12. Skid path. 13. Petrol storage. 14. Diesel oil storage. 15. Road fuelling point. 16. Driving school. 17. Air compressor. 18. Unit cleaning. 19. Smithy. 20. Electrical rolling stock shop. 21. Road and rail machine shop. 22. Test. 23. Electrical and mechanical plant shops. 24 Diesel pump shop. 25. Sheet metal shop. 26. Trimming shop. 27. Hard standing open park for road vehicles. Arrows indicate the flow of maintenance and annual overhaul work

Main shop lighting

Electricity distribution follows conventional lines. A substation to the west of the main factory block receives a supply at 6·6 kV from the Belfast Corporation Electricity Department. Two 0·75 sq in single-core paper-insulated lead-covered cables per phase feed from each of two 750 kW transformers to the main distribution switchgear consisting of a twelve-panel switchboard having a rupturing capacity of 30 MVA at 400 V. The two incoming supply panels are of 2,000 A and the nine distributing panels of 750 A capacity, a busbar coupling switch also being provided.

From the seven power distributing panels three-core and neutral 0·3 sq in p.i.l.c. single-wire-armoured cables feed power distribution switchboards in various parts of the factory, the route being underground between buildings and overhead in the factory roof inside the main works. From each of the two main lighting switches two 0·5 sq in single-core cables per phase feed lighting distribution panels with 300 A air-break switchgear in the main switchroom, while three-core and neutral cables, similar to the power cables, supply the eight lighting distribution switchboards in various parts of the factory. A comprehensive system of ring mains is provided for both power and lighting systems linking up each pair of switchboards. These switchboards consist of main incoming switches and busbars of 600 A for power and 300 A for lighting with accompanying switches and high rupturing capacity distribution fuseboards. The final distribution to the various machines is carried out underground in the concrete floor, so as not to interfere with the system of overhead cranes in the factory roof.

Lighting Arrangements

The lighting in the main portion of the factory is generally by means of separate 750 W tungsten and 400 W mercury vapour discharge lamps, spaced alternately in the factory roof 20ft above floor level. This gives a bench level illumination of 15 to 20 ft-candles. Such a scheme of mixed lighting was found to blend admirably and to avoid stroboscopic or other defects.

In the combined road and rail paint shop, however, continuous lines of twin tube natural fluorescent fittings are installed between lines of buses, lorries and rail coaches. These are mounted 17ft above the floor and give an illumination of 20 to 25 ft-candles. The mechanical and electrical plant shops are illuminated by similar twin-tube fluorescent fittings fixed at a height of 11ft to give a high intensity of illumination. The plant shops, situated mainly beneath a block of offices, receive

Road running shop lighting

little daylight, and as armature winding is carried out here adequate lighting is essential. In the stores section single-tube trough type fluorescent fittings are used in lines between the storage bins, as this area has to be illuminated throughout the day. This method of lighting is found adequate without supplementation by portable handlamps. In the three main lines of pits stretching along the length of the chassis shop and in other shorter pits in the body and road running shops low voltage tungsten fittings behind armoured glass are located in the pit sides, each having a 25 V socket for handlamps.

Throughout the factory there is a system of 25 V handlamp sockets at all positions where they are likely to be required, so that the use of full voltage handlamps with consequent danger of shock is eliminated. A large number of 4-socket portable clusters are provided to allow for a number of handlamps to be used from one socket whenever necessary. A comprehensive system of plug sockets is provided throughout the factory, mounted on the main vertical building columns where convenient, or alternatively, in the inspection pits or on special service pillars situated at key positions. These socket outlets consist of 60 A three-phase for portable welding transformers, 30 A three-phase for heavy power, generally used for carriage and wagon lifting jacks, 15 A single-phase for heating and certain special small power tools, and 125 V three-phase for the "Hicycle" tool installation. The plugs for each service are, of course, non-interchangeable with other services.

Three "Hicycle" frequency-changing sets are located in the carriage and wagon shop, body shop, and fitting shop, feeding approximately 70 sockets and generating at 125 V three-phase, 200 c/s. Each frequency changer is ringed with the others so that two of these three sets could keep the whole factory supplied if necessary. A number of four-cluster boxes are provided to permit more than one tool to be operated from one plug point. In the case of the body shop it was found necessary for both "Hicycle" and low voltage handlamp sockets to be suspended from the roof to allow for uninterrupted movement of vehicle bodies over the floor area below.

Crane System

Material is handled by means of a comprehensive system of 2-ton and 4-ton overhead electric three-motor travelling cranes covering the greater part of the factory area. These cranes are push-button controlled from ground level, operating on a latching system by which a load can be

cross-travelled from crane to crane across the various bays of the works.

The main building is warmed by a system of unit heaters with thermostatically controlled electric circulating fans, the stop and start switches being in most cases brought to a common point to assist switching when necessary.

The electric rolling stock and battery shops are equipped with full testing facilities for complete overhaul of electrical equipment on road vehicles and also for maintenance and renewal of train lighting equipment on carriages. All benches in this shop have independent adjustable low voltage inspection lighting and also 24, 12 and 6 V d.c. plug-in test points together with a 50 V a.c. socket for series testing. Test beds are also provided for the testing of road and rail dynamos and ancillary equipment. In connection with road rolling stock alone, approximately 1,300 dynamos, 1,500 starters, 1,500 magnetos, 650 control panels, 1,600 windscreen wipers and 3,000 miscellaneous electrical units are dealt with annually in this repair shop, each unit being inspected and passed before issue, while in the battery section, which is complete with all the necessary lead burning and charging facilities, about 4,000 road vehicle batteries are dealt with annually.

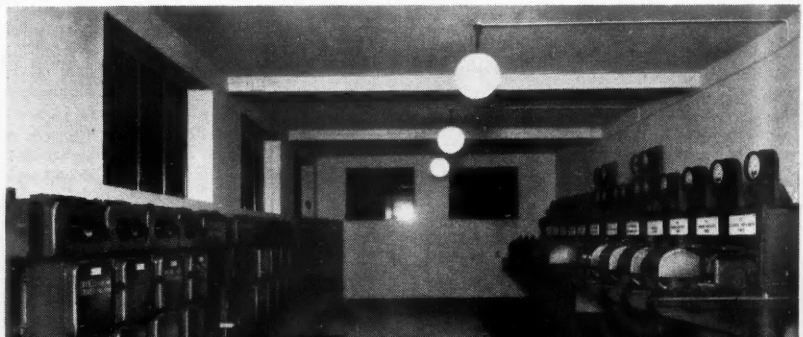
The diesel and petrol engine test house has three test beds, each equipped with starting supplies of 24, 12 and 6 V and coil ignition supplies of 12 and 6 V, all being obtained from transformers and rectifiers. When completed, a bank of contactors mounted on a switchboard will control the supply of electricity to each test bed. At the latter point a test engineer will select the supply required by pressing one of the series of push-button switches mounted outside the test house for safety, but operated from inside by extension rods fully interlocked to prevent inadvertent operation. The supply cables in the test house will be installed overhead to eliminate trailing cables.

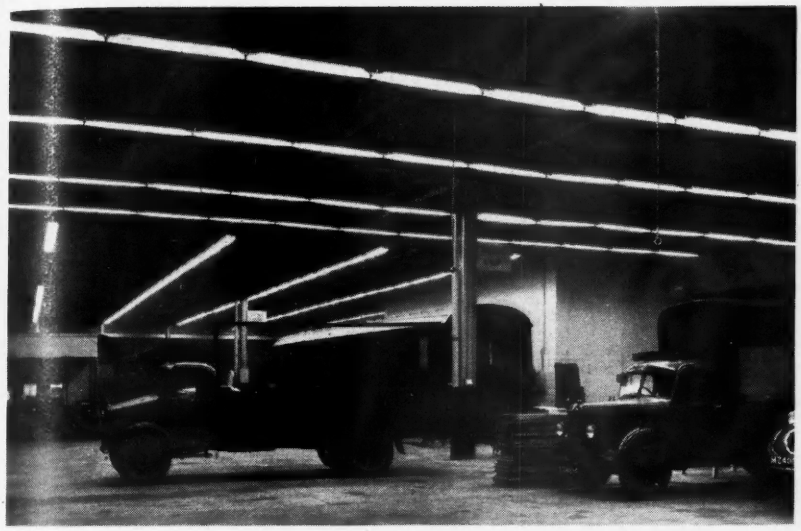
Maintenance Work

In the electrical and mechanical plant shops all cranes, lifts, pumps and electrical installations used by the Authority throughout Northern Ireland are maintained. Repairs and re-winds of motors and control gear of all types are carried out here, the shop being equipped with test benches and multi-voltage services.

Comprehensive communication facilities are provided. A 100-line factory and office intercommunication system connecting the office block with all the factory shops

The substation is a separate building to the west of the factory





Continuous twin tube fluorescent lighting in the paint shop

and offices is in use for general works administration. A 100-extension Post Office switchboard has, in addition to fifteen incoming Post Office exchange lines, a number of private wires linking the factory with the headquarters of the Authority in the city and also with York Road Station and other depots. At York Road calls can be plugged through on to the Authority's privately owned trunk telephone system linking Belfast with Larne, Ballymena, Coleraine, and Londonderry, about 90 miles away, together with various intervening stations and road depots. A staff location system will shortly be completed with about 70 loudspeakers, covering the whole area of the factory and offices.

The main electrical installation work was carried out by the Authority's own staff under the direction and control of Mr. James Courtney, the chief engineer, who has given permission for this article to be published.

The principal suppliers of the electrical equipment were: main substation switchgear, A. Reyrolle & Co., Ltd.; main feeder cables, British Insulated Callender's Cables, Ltd.; sub-distribution boards and equipment, English Electric Co., Ltd.; main overhead factory lighting, Edison Swan Electrical Co., Ltd.; continuous double lines of fluorescent tubes in the paint shop, General Electric Co., Ltd.; overhead cranes, George King & Co., Ltd.; electric traverser, Henry Lees & Co., Ltd.; "Hicycle" tool installation, Consolidated Pneumatic Tool Co., Ltd.; staff location system, Philips Electrical, Ltd.

Australian Notes

THE first stage of the Tully Falls hydro-electric scheme in Queensland, which is estimated to cost £7,636,000, is expected to be in operation in 1955. Announcing this, the State Premier (Mr. Hanlon) said that it would provide enough power until the total scheme, costing more than £11½ million, was completed. A tender of £318,654 by the English Electric Co. for two 18,000 kW turbo-generators has been accepted.

The 50,000 kW hydro-electric power station to be erected at Hume Weir is expected to be completed by 1953. Output will be shared equally by New South Wales and Victoria.

The Electric Light and Power Supply Corporation, Ltd., Sydney, has been ordered by the Land and Valuation Court to submit a valuation of the undertaking as a going concern as at 31st October. This is the result of a preliminary hearing under terms of the Electricity Commission (Balmain Electric Light Company Purchase) Act.

E.T.U. Conference

Points from Presidential Address

FURTHER expansion in membership of the Electrical Trades Union is recorded in the report of the Executive Council presented at the fifth annual delegate conference of the Union held this week at Hastings. Since 1945, when the number of members, at 138,567, had risen to twice the pre-war figure, membership has increased to 187,520 in 1949 and 192,339 at the end of last year.

The section of the report on the Union's organization also refers to the lengthy search to obtain premises for the proposed E.T.U. College; the Council is not yet able to report success. The progress of negotiations on wages and conditions is reviewed, showing gains achieved, while a later section on policy outlines the action taken on resolutions passed at last year's conference. One of these was concerned with the enforcement of regulations to make domestic apparatus safe; in a letter the deputy secretary of the B.E.A. had said it was quite conceivable that if investigations which the Authority and Area Boards had in mind pointed to the necessity for mandatory status for the I.E.E. Regulations or other measures it might be necessary to seek revision of the 1937 Electricity Supply Regulations. A letter from the secretary of the Standing Inter-departmental Committee on Accidents in the Home (Ministry of Supply) indicated that there was insufficient evidence that accidents attributable to the causes mentioned were sufficiently numerous to justify action at present.

Presidential Address

The conference opened on Monday with an address by the Mayor of Hastings, Alderman J. D. Cooper, after which Mr. Frank Foulkes delivered his presidential address. Referring to nationalization of the electricity supply industry, he expressed keen disappointment with the progress made, particularly in regard to the relationship between workers and management. In his opinion this was entirely due to the administrators. The attitude of the management to the workers had not changed, neither had the basis of wage adjustment. While the method of presenting the accounts had altered, the fundamental principle of capitalism remained. Interest on loans, compensation payments and surplus were still the first charge on the industry, thus determining the wages of manual workers. Artificial barriers still existed between "black-coated," technical and manual workers. An adequate sick pay scheme and a superannuation fund were not considered necessary for manual workers although the technical, administrative and clerical staffs received these benefits. The Union must demand direct participation by workers in management; complete liquidation of compensation stock; lowering of interest on loans; a new method of approach to wage claims based on the individual's value to the industry; and that wage and salary adjustments should be the subject of precise pre-budgeting.

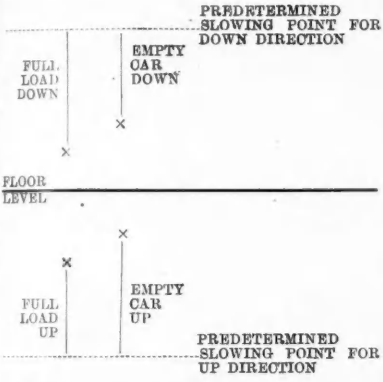
Dealing with the dispute involving contracting departments of the London Electricity Board, Mr. Foulkes said it was a challenge to the Union's role of sole negotiators within the electrical contracting industry, although an attempt was made to persuade workers and the public that it was an inter-union dispute. The rights of the E.T.U. within the contracting industry had never been challenged by electricity supply employers, but advantage had been taken of nationalization to undermine its traditional strength within the contracting industry. The dispute at Bethnal Green could easily have been settled had not the significance of the move been so apparent. The B.E.A. had reported to Parliament that all but 150 employees (including lawyers and others without trade unions) would be covered by negotiating machinery, presupposing that the E.T.U.'s 10,000 members in the contracting industry would ultimately conform to the will of the B.E.A. Whatever the result of the inquiry they must continue the struggle because of the principles involved.

Lift Speeds

Comparison of Short-Journey Performances

By J. N. WELCH*

IT is generally assumed, all other things being equal, that the higher the contract speed of a passenger lift the shorter is the time it takes to complete a journey. If, however, a large proportion of the operation consists of single- or two-floor journeys, as is the case in shops, departmental stores and some office blocks, it may be that an increase in contract speed will have the reverse effect and make the journey time longer.



x—POINT AT WHICH LIFT CAR HAS DECELERATED TO CONSTANT LEVELLING SPEED

Fig. 1.—Diagrammatic representation of "creep" levelling distances

The requirement of reasonably accurate floor levelling without an unduly severe braking effort means that the generally accepted maximum speed for a single-speed passenger lift is of the order of 120 ft/min. Above this limit some form of speed-change equipment is required and for a.c. lifts it usually consists of a two-speed motor. Whatever means is used the result is generally that the lift will start from rest, accelerate to the higher (or highest) speed and then run at contract speed until it reaches a predetermined distance in advance of the floor at which it is desired to stop. It will then commence to decelerate until it reaches its lowest, or levelling, speed and the car will come to rest on reaching the desired floor level.

With the usual method of achieving this result by a.c. motors, there is the disadvantage that the distance needed to slow from the higher to the lower, or levelling, speed varies according to the load in the car and the direction of travel. This means that the point at which the lift commences to slow must be sufficiently in advance of the desired stopping point to enable the lift to be smoothly decelerated when lowering a car with full load, or, conversely, when lifting an empty car. When the conditions are reversed, while raising a full load or lowering an empty car, the deceleration takes place over a comparatively shorter distance and, therefore, with a constant initial decelerating point, the lift will have to "creep," or travel at levelling speed, for a longer distance to floor level (Fig. 1).

Various means have been tried, in the past, to overcome this disadvantage, with varying degrees of success, but all have been comparatively short-lived. All methods at present generally used for decelerating a.c. motors suffer from this disadvantage.

From two passenger lifts recently installed in the West End of London the data in Table I were obtained after the lifts had been

TABLE I

	Lift "A"	Lift "B"
Contract speed: (top)	179 ft/min	199 ft/min
(levelling) ..	59 ft/min	60 ft/min
Load	750lb	1,050lb
Predetermined slowdown distance	3ft 1½in	4ft 3in
Actual slowdown distance:		
Empty car up	2ft 8½in	3ft 9in
Empty car down	1ft 2½in	1ft 11in
Full load up	1ft 5 in	1ft 10in
Full load down	2ft 6 in	3ft 10in
Distance travelled at levelling speed:		
Empty car up	5 in	6in
Empty car down	1ft 11 in	2ft 4in
Full load up	1ft 8½in	2ft 5in
Full load down	7½in	5in
Acceleration distance for half load	1ft 3 in	1ft 11in

*Chief Inspector, Keighley Lifts, Ltd.

adjusted to give the best deceleration and smoothness of change-over from high speed to low speed.

From this it will be noted that the high speed/low speed ratio of lift "A" is approximately 3 to 1 whereas that of lift "B" is about 4 to 1 in order to secure approximately the same levelling speeds (59 and 50 ft/min respectively) to ensure reasonably accurate floor levelling. It will also be seen that the contract load is not the same in each case. Both lifts were adjusted for a minimum levelling distance of 5in to cover any variation in deceleration distance owing to such causes as the heating of the motor or slowing resistances, and this margin should prevent the lift car going past the required floor level.

If the average journey times are calculated for, say, a 10ft floor height, assuming an average half contract load in the car, using the formula:—

$$t = \frac{2s}{V_1 + V_2}$$

when t = time in sec,
s = distance in ft,
V_1 = initial velocity in ft/sec and
V_2 = final velocity in ft/sec

then we obtain the results given in Tables II and III. The average time for a one-floor journey on lift "A" is therefore 4·908 sec and on lift "B" 5·389 sec.

It can be said that owing to the difference between contract loads the two lifts are not comparable. Assume, therefore, that lift "A" is balanced for a contract load of 1,050lb. With the present variation in decelerating distance of 1ft 3½in for a difference in load of 750lb, we assume that for a contract load of 1,050lb the difference between deceleration distances with full load and empty car will be 1ft 9⅞in. This, therefore, makes the predetermined deceleration distance 3ft 7⅞in. If we now calculate the revised journey times we obtain those in Table IV.

TABLE II

Lift "A"		
Half load down:		
Acceleration from rest to 199 ft/min	1ft 3 in	0·847 sec
Run at contract speed of 199 ft/min	5ft 7½in	1·888 sec
Deceleration from 179 to 59 ft/min	1ft 10¼in	0·935 sec
Run at levelling speed of 59 ft/min	1ft 3½in	1·290 sec
		4·960 sec
Half load up:		
Acceleration from rest to 179 ft/min	1ft 3 in	0·847 sec
Run at contract speed of 179 ft/min	5ft 7½in	1·888 sec
Deceleration from 179 to 59 ft/min	2ft 0⅜in	1·042 sec
Run at levelling speed of 59 ft/min	1ft 0⅜in	1·080 sec
		4·857 sec

TABLE III

Lift "B"		
Half load down:		
Acceleration from rest to 199 ft/min	1ft 11 in	1·155 sec
Run at contract speed of 199 ft/min	3ft 10 in	1·165 sec
Deceleration from 199 to 50 ft/min	2ft 10⅛in	1·387 sec
Run at levelling speed of 50 ft/min	1ft 4½in	1·650 sec
		5·357 sec
Half load up:		
Acceleration from rest to 199 ft/min	1ft 11 in	1·155 sec
Run at contract speed of 199 ft/min	3ft 10 in	1·165 sec
Deceleration from 199 to 50 ft/min	2ft 9⅛in	1·342 sec
Run at levelling speed of 50 ft/min	1ft 5½in	1·750 sec
		5·412 sec

TABLE IV

Lift "A"		
Half load down:		
Acceleration from rest to 179 ft/min	1ft 3 in	0·847 sec
Run at contract speed of 179 ft/min	5ft 1½in	1·720 sec
Deceleration from 179 to 59 ft/min	2ft 1½in	1·062 sec
Run at levelling speed of 59 ft/min	1ft 6½in	1·545 sec
		5·174 sec
Half load up:		
Acceleration from rest to 179 ft/min	1ft 3 in	0·847 sec
Run at contract speed of 179 ft/min	5ft 1½in	1·715 sec
Deceleration from 179 to 59 ft/min	2ft 3⅞in	1·171 sec
Run at levelling speed of 59 ft/min	1ft 3⅞in	1·345 sec
		5·088 sec

Therefore, the average time for a one-floor journey based on a contract load of 1,050lb for lift "A" is 5·131 sec, which is still a shorter time than that of 5·389 sec for a similar journey for lift "B."

Alternatively, we can calculate the times for lift "B" based on a contract load of 750lb. For a variation in deceleration distance of 1ft 11in for a difference in load

of 1,050lb we can assume that for a contract load of 750lb the difference in deceleration distance between full load and empty car will be 1ft 4½in. This makes the predetermined deceleration distance 3ft 8½in. We can now calculate the revised journey times as in Table V.

TABLE V

Lift "B"			
Half load down:			
Acceleration from rest to 199 ft/min	1ft 11 in	1·155 sec	
Run at contract speed of 199 ft/min	4ft 4½in	1·320 sec	
Deceleration from 199 to 50 ft/min	2ft 7½in	1·260 sec	
Run at levelling speed of 50 ft/min	1ft 1½in	1·328 sec	
			5·063 sec
Half load up:			
Acceleration from rest to 199 ft/min	1ft 11 in	1·155 sec	
Run at contract speed of 199 ft/min	4ft 4½in	1·320 sec	
Deceleration from 199 to 50 ft/min	2ft 6½in	1·230 sec	
Run at levelling speed of 50 ft/min	1ft 2½in	1·420 sec	
			5·125 sec

Therefore, the average time for a one-floor journey based on a contract load of 750lb for lift "B" is 5·094 sec, which is still longer than the 4·908 sec for a similar journey of lift "A."

Now if we calculate the times for a one-floor journey when lifting full load (still basing our calculations on the 750lb contract load for both lifts) we obtain those in Table VI.

TABLE VI

Lift "A"			
Acceleration from rest to 179 ft/min	1ft 3 in	0·847 sec	
Run at contract speed of 179 ft/min	5ft 7½in	1·888 sec	
Deceleration from 179 to 59 ft/min	1ft 5 in	0·714 sec	
Run at levelling speed of 59 ft/min	1ft 8½in	1·735 sec	
			5·184 sec
Lift "B"			
Acceleration from rest to 199 ft/min	1ft 11 in	1·155 sec	
Run at contract speed of 199 ft/min	4ft 4½in	1·340 sec	
Deceleration from 199 to 50 ft/min	1ft 10 in	0·884 sec	
Run at levelling speed of 50 ft/min	1ft 10½in	2·250 sec	
			5·629 sec

Similarly, for a one-floor journey when lifting an empty car we obtain the results in Table VII.

TABLE VII

Lift "A"			
Acceleration from rest to 179 ft/min	1ft 3 in	0·847 sec	
Run at contract speed of 179 ft/min	5ft 7½in	1·888 sec	
Deceleration from 179 to 59 ft/min	2ft 8½in	1·364 sec	
Run at levelling speed of 59 ft/min	— 5 in	0·425 sec	
			4·524 sec
Lift "B"			
Acceleration from rest to 199 ft/min	1ft 11 in	1·155 sec	
Run at contract speed of 199 ft/min	4ft 4½in	1·340 sec	
Deceleration from 199 to 50 ft/min	3ft 2½in	1·548 sec	
Run at levelling speed of 50 ft/min	— 6 in	0·600 sec	
			4·643 sec

From the above, therefore, it can be seen that lift "A" with the lower contract speed takes less time to travel between two consecutive floors under full load, half load and with an empty car.

REINFORCED CONCRETE

Pre-Stressing Methods

IN a paper presented before the Institution of Engineers-in-Charge on 11th April, Mr. H. G. Cousins described salient features in the making and use of concrete, including shell roofing and æsthetic aspects among many modern developments. Crushing strength at an age of 28 days, he said, was generally 2,500 to 5,000 lb/sq in, but in high quality work might exceed 8,000 lb/sq in. Tensile strength, however, was usually not more than 10 per cent of compression strength and so a semi-rigid cage of mild steel was introduced as reinforcement.

A recent advance was pre-stressing which prevented the concrete from coming into tension. Two methods were employed. In the first, concrete was poured round already tensioned wires, the tension being released only after hardening; this process was adopted chiefly for factory products, such as flooring units and beams for assembly on site.

In the second method, which was really post-tensioning, concrete was cast first *in situ* and hardened, when wire cables were stretched between anchorages bearing on the ends of the concrete member and then grouted up; its purpose was to hold the stressing force during hardening where anchorage would otherwise not be obtainable.

Drying by Electric Heating

Papers at Institute of Fuel Conference

THE possibility of applying electric heating—in one form or another—to industrial drying processes was among the subjects discussed at a recent conference organized by the Institute of Fuel.

Construction of tubular and flat sheathed heating elements was the main subject of a paper by J. T. Sharples entitled "Heating by Electrical Elements." Mr. Sharples also discussed the placing of elements in contact driers, such as cylinder and platen types and also in forced-convection driers. Some reference was made to their possible use in radiant-heat driers. The advantages of the tubular elements are considerable. They can be bent to any contour or size to conform with the articles being dried or with the design of the drier itself. In one application, a tubular element has been put inside a cylinder having a through bore of only 2in diameter. The advantage of this type of heating is that the heat can be generated at or very near the point of use. This reduces heat transmission losses, and thereby compensates to some extent for the higher cost of electricity for heating.

The author gave illustrations of the various ways of fitting the tubular elements to platens. With sheath temperatures up to 800 deg C (1,472 deg F) the heat input can be as high as 17,000 B.Th.U./hr per sq ft of working surface. The sheathed element is of course a little safer than the bare wire element but there are cases where the latter is of advantage.

Sheathed elements can be used for radiant heating. It is interesting to compare their performance with that of filament lamp radiators. The spectral distribution of the two types is different. The filament lamp has a narrow range—with a peak of 11,000 Angstrom units at 2,200 deg C. From a surface at 750 deg C, there is much broader distribution with a peak at 30,000 Å, the latter being one of the absorption peaks for water. On wavelength and energy considerations the tubular sheathed element at a surface temperature of about 750 deg C is eminently suitable for radiant-heat drying.

In the discussion it was suggested that greater advantage would be obtained from the higher intensity of an equivalent open wire-wound emitter, since the solid as well as the water must be heated. In reply the author maintained that high intensity is not required for this purpose and that the sheathed element is satisfactory. Furthermore, although thermal efficiency is little more than 5 per cent for radiant heating, the low capital cost, extreme convenience and speed of operation override this disadvantage for processes where radiant heating is suitable. These are chiefly cases of moving stock where the thickness to be dried is quite small or where diffusion of moisture is very rapid.

There was reference in another paper to the desirability of an adequate convection current to remove vapour. This is essential for the efficient use of radiant heating. The emission of the heater, however, is not so important as the heat absorption of material under treatment and the practicability of matching the peak emission wavelength to the absorption wavelength of the stock. This unfortunately varies not only with the material but also with the colour. A good deal of investigation is still needed into the absorption and reflection characteristics of various materials. It may be possible to take advantage of changes in these characteristics during drying for developing automatic control of the heat source.

Dielectric Loss Heating

A contributor to the discussion emphasized the value of high-frequency heating. In the case of drying this of course means heating by dielectric loss. The unique advantage of this method is that the heat is developed almost uniformly throughout a homogeneous mass. There is therefore no large temperature gradient as with other methods of heating. Heating is extremely rapid and temperature can be

controlled within fine limits. The time for heating-up is enormously reduced. For example, a 2in block of wood can be dried by this means in one-tenth the time taken by other methods. Similar large savings in time have been found with other materials. Unfortunately, the method is far too expensive for general application. Only 50 per cent of the power used appears as heat in the material, while capital and maintenance costs are so high that total costs for drying are little less than 1d per lb of water removed.

An interesting method of increasing thermal efficiency was described in which use is made of the heat in the air used for cooling the thermionic valves. Although an increase of 10 per cent in thermal efficiency was obtained, the total cost would not be greatly lowered thereby. An instance showing particular advantage is in the drying of rayon cakes. If these are dried by warm air at an appreciable rate, they shrink seriously in the outer layers and become damaged. Dielectric heating overcomes this difficulty of case-hardening and permits a much higher rate of drying. The method has been investigated as an aid to the drying of many materials of suitable form such as foundry cores, packaged textiles, glued plywood and compressed foods.

With most materials the method is shown to possess undoubted advantages, but only in a few cases have the advantages outweighed the expense and made commercial application practicable. In other cases earlier optimism has not been justified by later experiments. For example, the difficulty of applying the method to ceramic ware was described in a paper on " Drying in the Pottery Industry," given at another session of the conference. Successful laboratory experiments with small samples of some materials such as wood are unfortunately a very uncertain guide to the behaviour of the materials in bulk if they are dried by the dielectric method. This greatly adds to the difficulty of using this technique.

News from Ireland

From Our Dublin Correspondent

FOR some time past the Irish Electricity Supply Board has experienced difficulties owing to the increasing consumption which during the past twelve months has been at the rate of 21 per cent. Last year the coincidence of an unusually wet summer made it possible for the hydro stations to achieve record output figures and thereby keep in step with the growing demand. Now, however, the rising cost of coal and the shortage of other fuels have expanded the use of electricity to such an extent that it is impossible for the existing generating plant to meet the demand. The position will be worsened if a dry spell occurs. In a notice to consumers the Board asks all users to reduce their consumption, particularly between the hours of 9 a.m. and 6 p.m. It is suggested that, except during the night hours, water heaters and space heating should not be used.

The Belgian industrial concern, Ateliers de Construction Electriques de Charleroi, is setting up at Waterford what is described as the biggest electrical factory in the country. A 35-acre site (a disused horse racing establishment) has been acquired at Tycor, on the outskirts of Waterford and the first building, which is expected to be finished next year, will cover an area of 2,500 sq yd. All kinds of electrical apparatus will be produced including transformers, motors, generators, switchgear, electronic tubes and power cables for all voltages. Plans have been made for building up a considerable export trade. Three Irish engineers are already being trained in Belgium and will return to Ireland for the installation of the plant.

The Royal Dublin Society's Spring Show and Industries Fair at Ballsbridge has proved a great success. One of the main features was a television demonstration organized with remarkable perfection by Pye (Ireland), Ltd. The cameras were set up at a corner of the jumping enclosure and fifteen receivers were provided. Expectations of a service being inaugurated in Ireland, however, were upset by the Minister for Posts and Telegraphs who declared in the Dail that a relatively long period would elapse before Irish television would become a practical possibility.

The E.S.B. had stands in the main hal and paddock showing the great possibilities opened up for the revival of rural industries with the aid of electricity. Among interesting exhibits of the Aberdare Electric Co., Ltd., were models of its electric thermal storage space heaters. A range of the smaller distribution transformers now being produced in quantity at the works at Finglas for rural electrification was on view.

Commerce and Industry

Non-Ferrous Scrap Prices

South African Electrical Imports

THE Minister of Supply has made the Non-Ferrous Metals Prices (No. 4) Order, Statutory Instrument 1951 No. 773, which consolidates earlier Orders, revises certain maximum prices of scrap, and provides for special prices for exceptional transactions. Other changes permit bona fide scrap metal merchants to charge a commission of 1½ per cent on remelted lead, and to increase the maximum charge for bricquetting to £2 per ton. In addition the maximum price for scrap not mentioned in the Order, may be fixed by agreement between the buyer and seller. The agreed price, however, must not exceed the highest scheduled price for material in the same class. Provision is also made for special prices for scrap chemical lead and for scrap produced in technical colleges, and for the Minister to authorize special prices for scrap which has to be sorted to unusual requirements.

Forward Purchasing of Metals

The Minister of Supply has standardized the arrangements for forward purchasing of copper, lead and zinc from the Directorate of Non-Ferrous Metals at Rugby. Consumers may now buy, without premium, their full quota for the current month, and may buy up to their current quota for delivery in the succeeding month. In the event of the quota being reduced before deliveries for the succeeding month can be made, the actual deliveries by the Directorate of Non-Ferrous Metals will be restricted to the lower quota, any balance of purchases being carried forward at the price applying when the order was placed. No further forward purchases will be permitted for the time being. This change brings copper and zinc into line with lead.

Electrical Prosecutions in Victoria

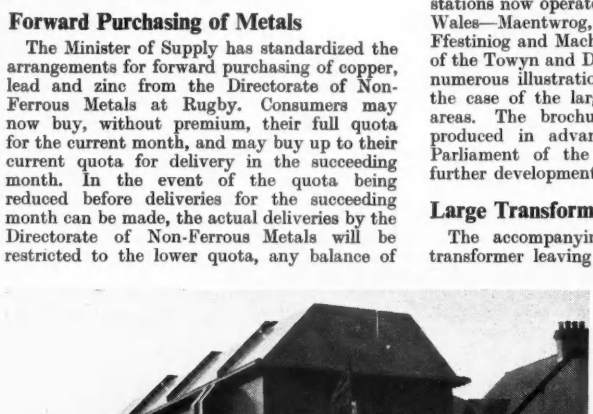
During 1950 thirty persons were convicted in Victoria for carrying out electrical work when not licensed as electrical mechanics. There were also convictions against eighteen unregistered contractors for undertaking wiring work.

North Wales Water Power

For the Merseyside and North Wales Division of the B.E.A., Garraway, Ltd., have produced a 20-page booklet describing the hydro-electric stations now operated by the Division in North Wales—Maentwrog, Dolgarrog, Cwm Dyli, Ffestiniog and Machynlleth, with brief mention of the Towyn and Dolgelley installations. The numerous illustrations show the plants and in the case of the larger stations the catchment areas. The brochure appears to have been produced in advance of the submission to Parliament of the B.E.A.'s scheme for the further development of Welsh water power.

Large Transformer for Finland

The accompanying picture shows a large transformer leaving the English Electric Co.'s works at Stafford on 27th April on the first stage of its journey to Finland. The equipment is being supplied through the company's agents in Finland, De Jersey of Helsinki, to the order of Imatran Voima, O/Y. It will be installed in a substation at Petajavesi. The transformer is a 64,000 kVA 3-phase unit, having a

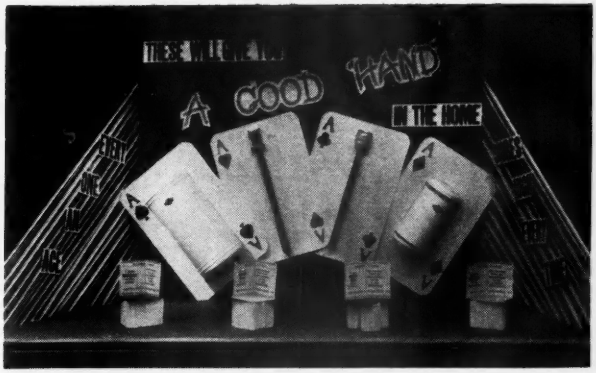


An English Electric 64,000 kVA transformer en route for Finland

ratio of 225/112·5/10·5 kV provided with ON/OFB type cooling and equipped with on load tap changing gear on the 112·5 kV winding.

South Western Window Displays

The Area challenge cup for the second window display competition organized by the South Western Electricity Board has been won by the Bude Service Centre, with Truro second and Colston Avenue, Bristol, third. Penzance, Lynton and Portishead were highly commended. In all there were 101 window displays entered for the competition by 95 service centres throughout the South West.



The winning display by the Bude Service Centre of the South Western Electricity Board

New Bristol Showrooms

New West Country showrooms at 142, Victoria Street, Bristol, were recently opened by Jackson Boilers, Ltd. The ceremony was performed by Mr. Maddock, sales director and was followed by a luncheon. The new showrooms have three spacious windows while the interior of the showroom, which is panelled in mahogany, displays a selection of the company's boilers connected up for demonstration purposes. A special display feature is an old Jackson boiler, which was recently removed from Gloucestershire, where it had worked in a hard water district, giving thirty-three years of continuous service. Behind the showroom there is a well-appointed manager's office, and below, a roomy basement for storage of stock machines and spares, etc. Mr. J. Vickers is the West Country manager.

Gauge and Tool Exhibition

On Tuesday next the Gauge and Tool Exhibition will open at the New Royal Horticultural Hall, London, S.W.1, and will continue until 25th May.

In conjunction with the exhibition the Gauge and Tool Makers' Association is holding a dinner-dance at the Savoy Hotel, London, W.C.2, on 18th May.

Electrician's Death

Ernest Edwards (40), an electrician employed by I.C.I. at South Works, Buxton, received a fatal electric shock while making a repair to an overhead wire. Mr. A. R. Groom, electrical maintenance engineer, stated that the electrician was responsible for switching off the power, but the jury, in returning a verdict of "Accidental death," added the opinion that the responsibility for switching off should be with the foreman electrician.

Higher Management Lectures

A series of lectures on higher management has been arranged by the London Centre of the Institute of Industrial Administration, to be held on Wednesdays from 16th May to 13th June at the Regent Street Polytechnic, London, W.1. The title of the series is "The Tools of Management—Planning and Control." Particulars can be obtained from Mr. W. T. Pope, 44, Horn Park Lane, London, S.E.12.

Trader Handbook

Over 450 pages of essential information for manufacturers, trade suppliers and repairers of motor, motor cycle and cycle goods are given in "The Trader Handbook" for 1951 just published. The contents have been checked throughout and brought up-to-date. Its practical and comprehensive treatment of every aspect of these industries provides accurate and useful answers to the daily problems of buying, selling and servicing throughout the year. It will also prove of great value to overseas firms seeking contact with British suppliers. A number of new features are included and other sections have been brought up-to-date. The handbook is published by the Trader Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1, at 12s 6d post free.

Engineers' Guild

An Edinburgh and District Centre of the Engineers' Guild was formed at a meeting held in Edinburgh on 9th April. Major D. Kerr Duff was elected chairman, and Messrs. D. L. G.

Hunter and P. Butler vice-chairmen. Mr. E. H. Nicoll was elected hon. secretary and treasurer. Addresses were given by Mr. R. Chalmers, the national president and Mr. W. Boyle, chairman of the Scottish Branch of the Guild.

South African Imports

According to the latest abstract of trade statistics issued in Pretoria, imports of electrical goods into the Union of South Africa last year were about 12 per cent less in value than in 1949. The reductions were in consumption goods rather than in capital goods: those in cable and wire were heavy. The chief items are shown in the accompanying table. No details of the countries participating in the electrical import trade are given, but in 1950 imports of all merchandise from the United Kingdom were valued at £113,964,000 out of a grand total of £287,103,000. The next largest share in the total trade was taken by the United States with £43,919,000.

Class of goods	1949 £(000)	1950 £(000)
Batteries and parts	650	474
Dynamos and generators	767	921
Electric motors	1,416	1,599
Transformers	998	1,621
Cable and wire (rubber insulated) ..	741	425
Cable and wire (other)	1,662	857
Electric stoves and parts	460	137
Electric lamp bulbs	388	391
Radio apparatus and accessories ..	1,251	790

Exports of electric cable and wire in 1950 were valued at £812,000, compared with £468,000 in 1949 and of machinery and parts (unspecified) £3,577,000 against £2,530,000.

Air Conditioning Plant

In the article on "Large Wool Mills" (*Electrical Review*, 13th April) we stated that the contractors for the air conditioning and heating installation included the Andrew Machine Construction Co., Ltd. We are informed by the Sturtevant Engineering Co., Ltd., that illustration No. 3 on page 721 shows two No. 16 MV/4 fans which it supplied to the Andrew Co. on the instructions of the consulting engineers, Sir Alexander Gibb & Partners.

Trade Announcements

Mr. T. A. Johnson, representative of **Bulpitt & Sons, Ltd.**, for Lancashire and North Wales, has moved to 18, School Road, Sale (telephone : Sale 3706).

Mr. J. W. Perry, London representative of **H. Clarke & Co. (Manchester), Ltd.**, has removed to 290, Carshalton Road, Sutton, Surrey (telephone : Vigilant 0521).

The activities of the T.N.J. Engineering Co., Ltd., and Burgess Armature Winding, Ltd., have been incorporated in a new company, **Tenjay Engineering, Ltd.**, 39-44, Cowper Street, City Road, London, E.C.2 (telephone : London Wall 9737-9; telegrams : "Tenjay, Ave, London"). Mr. D. David, contracts manager for many years, has been appointed to the board.

Holmes & Larkinson, electrical engineers and contractors, have removed to 30a, Falkirk Street, Shoreditch, London, N.1 (telephone : London Wall 9964).

Making Fluorescent Lamps

In the article on this subject in last week's issue the photographs on page 956 were inadvertently transposed. The lower picture showed the coated tubes emerging from the oven and the upper picture part of the ageing and testing process.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £124 0s 0d
COPPER, H.C. Electro	ton £210 0s 0d
Fire Refined 99·7 per cent ..	ton £209 0s 0d
Fire Refined 99·2 per cent ..	ton £208 10s 0d
LEAD, English	ton £161 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £1,140 0s 0d
ZINC, G.O.B. Foreign	ton £160 0s 0d
Electrolytic	ton £164 0s 0d
BRASS Tubes	lb 1s 10½d
Sheet	lb 2s 2d
Wire	lb 2s 4½d
COPPER Tubes	lb 2s 0½d
Sheet	ton £266 0s 0d
H.C. wire and strip	ton £235 5s 0d
PHOSPHOR BRONZE	
Wire	lb 3s 5d
RUBBER, No. 1 R.S.S. spot ..	lb 50d–50½d

Catalogues and Lists

Transformer & Electrical Co., Ltd., Eastern Works, Eastern Road, London, E.17—Catalogue of power transformers rated from 10 VA to 100 kVA.

Linolite, Ltd., 158 Bishopsgate, London, E.C.2.—Revised price list of lighting equipment and illustrated folder on decorative lighting fittings.

Standard Telephones & Cables, Ltd., Oakleigh Road, London, N.11.—Illustrated brochure on terminal link blocks.

Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.—Priced leaflet describing the "Fiesta-Flood" floodlight which has been specifically designed for Festival of Britain celebrations.

Morgan Crucible Co., Ltd., Battersea Church Road, London, S.W.11.—Wall chart of metric conversion tables.

Power in Western Europe

The Necessity for a Super-Grid is Questioned

By ING. VITTORIO DE BIASI*

IN a recent article[1] the secretary of the Electric Power Committee of the O.E.E.C. called attention to the super-grid problem, which has been, in the last few years, the subject of many studies.

Apart from political considerations and difficulties of an international character (which, at the present time, are anything but negligible and which the goodwill of the European Governments should be able to overcome), this survey of the present situation and of a possible solution will be carried out from strictly technical and economic points of view. From these standpoints the problem appears to be, above all, closely related to the distribution of the power resources and of the consumption areas in Europe (here and in what follows the term " Europe " means Western Europe). From an examination of the resources and also of the load data a general picture of the present conditions will be drawn to serve as a basis for the study of the most convenient solution to be adopted for the transmission of power.

To make clear the terminology used hereafter, " present resources of power " will mean those that have already at their disposal all the equipment and all the installations necessary for their utilization (for instance, mining equipment for a coalfield, hydraulic works and power generating stations for a catchment basin, shafts and pumping stations for an oil well, etc.), while " potential resources " will in contrast mean any resources for which no such facilities are yet available and the utilization of which will therefore be possible only in the future.

Hydraulic Resources

The situation of the present resources of hydraulic power is too well known to need dwelling upon. In nearly all European countries the hydraulic resources utilized for the production of electric power are insufficient to meet the requirements of their own areas of consumption and therefore power exchanges between neighbouring countries are limited.[2]

If we consider potential resources, it is known that the general shortage of electric power will not be made good in the next few years, at least not before the end of 1952, for which time more definite and detailed programmes and provisions have been drawn up.

At the end of 1952 the resources of the Alpine massif will have already been utilized to the extent of 35 to 40 per cent and if, as may be foreseen, consumption continues to increase at the same regular rate that has characterized its trend up to now, the said resources will be completely exploited in, say, 15 or 20 years' time and their consumption areas will have to contract progressively after that time.[3]

Substantially similar conclusions are arrived at by a survey of the other zones of hydraulic production. Even the hydraulic resources of the Scandinavian peninsula, though great, may largely be absorbed by local consumption, especially taking into account the possible development of special applications, favoured by the low cost per kWh in those countries and by the possible convenience of transporting the finished product, as for example in the case of the production of aluminium. The energy generated would in any case be subject to high transmission costs in order to reach the Continental areas of consumption.

Fuel Supplies

Fuel resources differ entirely from hydraulic ones and this fact should be brought into evidence at this early stage. In fact, while it may be considered that hydraulic resources do not change as time goes on and that, therefore, to exhaust their utilization only means to transform all potential resources into present ones, the fuel available is bound to be exhausted

* Consigliere-Direttore Generale Società Edison, Milano

and disappear in the course of time. It may be reckoned that the European solid fuel deposits known at present will be wholly exploited within a period of 500 to 1,000 years[4] and the possible duration of the liquid and gaseous fuels appears to be much shorter, but in this domain we are still at an initial stage, so far as research in Europe is concerned.

High and Low Grade Types

With regard to utilization of fuels, it is necessary to distinguish between "high grade" and "low grade" because the transport of the former to places more convenient for power generation and distribution may be an economical proposition, whereas utilization of the latter may be convenient only in power generating plants placed very close to the mine.

What are the respective power production possibilities of each of these two types of fuel? It is not easy to give an answer in exact quantities: a rough picture of the position may however be obtained by examining the construction programme of a country like Germany, which is rich in lignite. Since, according to such programmes, only 60 per cent of the new thermo-electric plants to be installed in Western Germany before the end of 1956 will burn low-grade fuel, it seems reasonable to infer that, even where large amounts of low grade fuel are available, their exploitation does obviously not replace the utilization of hard coal for the generation of electric power.

There is no doubt that in planning any new plant one is inclined to follow the criterion that the first one to be erected should be the plant capable of generating power at the lowest cost, but it is not necessarily true that, among the possible thermal plants, those using low grade fuel are always the less expensive ones to run.

As it has been seen and is well known, hydraulic power is nowadays substantially absorbed in the regions contiguous to the power stations. The question of systematic long distance transmission, which would justify the construction of a super-grid, need not be considered here: we shall deal farther on with the problem, if any, of seasonal compensation. The convenience of transmission to a very great distance can instead be considered in the case of thermic power, and the various possibilities should be weighed separately.

If high grade fuel is available and is to be utilized to supply electric power to a consumption centre far from the fuel deposits, one is confronted with the alternative of either producing the electric power in close proximity to the mine and transmitting the generated electricity to the consumption centre, or of carrying the fuel to generating plant near the consumption centre.

One may think that in both cases the cost of production would be the same and that, therefore, the solution of the problem from a strictly economic (or, we should say, accounting) viewpoint is to be found by a comparison of the cost of transmitting power with the cost of transporting fuel. The question has been discussed at length because the data to be taken into account are numerous, apt to vary in time and are often debatable. Anyhow, the opinion of the majority[5] is that the transport of high grade fuel is more economical than the transmission of electric power; a well-known French periodical recently remarked that coal transport tends to be more and more convenient "à mesure que les centrales thermiques améliorent leur rendement."[6]

It is pointed out, on this subject, that in view of the development of European means of transport either one could take advantage of the existing facilities for the transport of fuel, in which case no new capital investment would be required; or the river barges, railway trucks, ships, etc., which would have to be provided initially for this purpose, could be employed for the haulage of other goods, once the necessity of transporting fuel for generating electric power no longer existed

Factors Influencing Costs

On the other hand, in the case of the super-grid (the construction of which would call for considerable capital), the reduction of the power to be transmitted due, for instance, to increased local consumption in the zone near the production centre, would carry with it a reduction of the utilization of the lines and consequently an increase in the cost of transmission.

Again, it is to be noted that even if the cost of transmission of electric power were to be lower than the cost of fuel, the conclusion should not be jumped to that the construction of a super-grid would be economically justified. One should not lose sight of the fact that *it is preferable that the production centres be as near as possible to the*

centre of consumption because, obviously, the power distributing companies undertake to satisfy under the best conditions the requirements of their consumers. Therefore any causes of faults, typical of long distance lines and extended connecting networks, should be, as much as possible, eliminated. The frequency and consequences of such faults can be contained within certain limits by adopting the opportune measures and protective devices offered by modern technique, but the high cost of these measures would add to the cost of the lines, without the possibility of eliminating entirely the above-mentioned inconveniences. This supplementary outlay would then adversely affect the cost of transmitting power, altering considerably the result of all calculations drawn up so far which take into account only the cost of the lines forming the super-grid.

Instead, when low grade fuel is available, like the lignites of Western Germany, it is beyond doubt that it can be used for the production of electric power only in power stations built close to the mine. Obviously, these power stations will have to meet, first of all, local requirements. A study recently made by the E.C.E. enables one to foresee that Western Germany will suffer from a scarcity of electric power till 1957, provided the programmes planned are realized. Moreover, according to the same study, Western Germany will need to utilize in 1960 the whole of her natural resources in order to meet home consumption. One cannot therefore imagine, on the strength of these estimates, in which way large quantities of electricity produced from low grade fuels could be made available in the zones under consideration in future. But even if—by assumption—we should find ourselves in a condition of having to utilize, at a long distance, electricity produced by low grade fuels, it does not follow that the transmission of such power would necessarily require a European super-grid.

In fact if we examine, as an example, the case of a hypothetical export of electric power from the mining centres of Northern Europe to Italy, the situation briefly outlined above would be subject to the following additional considerations:—

Between Central-Northern Europe and Italy stretches the Alpine belt, rich in power plants, which would be crossed by the lines of the super-grid. But who, needing water on one side of a great lake (which could represent the whole of the power stations in the Alpine belt) and having at his disposal an excess of water on the opposite shore, would build an aqueduct over the lake in order to effect the transportation? In this case, entirely analogous to that of the transmission of power, it is evident that it would be convenient to let into the lake the excess of water and take out an equal quantity on the other shore. This analogy could be developed along many lines, but here we only want to consider it with regard to the exchanges of power in Continental Europe. It would not do to dwell here on the description of the load-shifting system, which has been for a long time applied satisfactorily.[7]

Network Interconnection

Now, to bring about exchanges of this kind it is sufficient that the internal networks of the individual countries be adequately strengthened and that the necessary marginal connections between adjoining networks be effected. Provisions of this kind are at present being carried out in the whole of Western Europe and also in Italy (with the construction of the 220 kV network on the way to completion and by strengthening the extra high voltage interconnections with Switzerland, Austria and France) aiming at maintaining her plant on the level necessary for the best utilization of the existing European power resources.

Experience has however taught that very long distance transmission of thermically produced power is generally infrequently required. As a matter of fact, in the construction of thermo-electric plants the prevailing tendency everywhere, as already pointed out, is to erect the power stations as near as possible to the consumption areas, thus reducing to the minimum the systematic exchange of power; this is also confirmed by the news of the very much extended interconnections of the American networks with a prevalently thermic production.[8] This tendency, then, becomes almost a necessity when the fuel deposits to be exploited are at a great distance from the consumption centre. It is in fact evident that one can rely with greater certainty on supplies obtainable through a power station near its load centre, not to mention the advantage deriving from the greater latitude in the choice of fuel both

with regard to fluctuations of the market and the possible discovery of nearer and more economical resources, as is, for instance, happening in Italy with methane gas. Casting a glance farther ahead in time, when progress of technique and diminution of other power sources will have made possible and convenient the utilization of nuclear energy for the production of electric power, certainly nobody will think of building new plants at a great distance from the consumption centres; in such an eventuality a super-grid would be of no use.

Seasonal Power

It now remains to deal with the utilization of the super-grid for the transmission of seasonal compensation power. Such transmission takes place at an intrinsically low load factor of the lines and consequently their cost becomes very high, if the respective lines have been erected for this specific purpose. Further, the building of thermic power stations in the proximity of the consumption centres offers the possibility of effecting on the spot compensation between thermic and hydraulic power, without requiring the construction of long lines; moreover, if in some cases the seasonal compensation should be made by power stations far from the consumption areas, here too the load-shifting system could be resorted to with undoubted advantage.

As to the other advantages attributed to the super-grid, it is not wished to enter here into details that have already been the subject of exhaustive discussions, but only to emphasize the fact that while the relative importance of such advantages tends to diminish as the extension of interconnection increases, some of the said advantages can already be usefully exploited through the marginal connections and the load-shifting system.

Some conclusions of a general character can be drawn from the foregoing *exposé*. The development of the European electrical networks witnessed in recent years is intimately bound up with a growing utilization of the hydro-electric resources in the individual countries and, thus, with the consequent necessity of linking together production centres with consumption centres which are often not in their immediate neighbourhood. But these resources in the power economy of Western Europe are moderate; they are going to be gradually wholly utilized and their consumption areas will have to contract progressively in the future.

With regard to the fuel resources, the increasing tendency to have new thermal power stations erected in the vicinity of the consumption areas will result also in a reduction in value of such a super-grid built *ex novo* and superimposed on the existing system.

It should therefore be borne in mind that, as Mr. Crary[9] has asserted in one of his recent papers, extra high voltage lines (as would be those of a European super-grid) " with their high kilowatt loading for optimum economy, essentially will be limited in their use for the delivery of power to large integrated systems capable of absorbing large blocks of power."

In conclusion, quoting a *Revue Française de l'Energie* article[6], everything allows for foreseeing that . . . " l'avenir immédiat ne verra . . . pas la création d'un réseau européen ou même intercontinental . . . , mais bien plutôt l'établissement de mailles sans cesse plus nombreuses entre les réseaux des divers pays d'Europe " . . .; besides, progressive and natural strengthening of the networks of individual countries and the respective marginal connections will anyway constitute a solid framework for any transmission of electric power, either directly or through the load-shifting system.

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ELECTRICITY SUPPLY

B.E.A. Contracts

Illuminations at Seaside Resorts

DURING the past month the British Electricity Authority has placed contracts for equipment for power stations, transforming stations and transmission lines amounting in the aggregate to £2,488,233. The principal contracts include: Bulk order for low pressure valves (J. Blakeborough & Sons, Ltd.); Tilbury power station: 132 kV 3,500 MVA switchgear (Metropolitan Vickers Electrical Co., Ltd.); Acton Lane "B" station, Willesden: Structural steelwork (Sir Wm. Arrol & Co., Ltd.); Brighton "B" station: Superstructure of administration block, garage and stores block (Holloway Bros. (London), Ltd.); Doncaster station: Coal handling plant (Mitchell Engineering, Ltd.); Huddersfield station: Boiler plant (Bennis Combustion, Ltd.); Portobello station: Boiler feed pumps (G. & J. Weir, Ltd.); Roosecote station, Barrow-in-Furness: Low pressure piping equipment (Simmons & Hawker, Ltd.); Drakelow station, nr. Burton-on-Trent: Site and foundation works (Sir Robert McAlpine & Sons (Midlands), Ltd.); Worthing substation: 132 kV 1,500 MVA switchgear (English Electric Co., Ltd.); Carmarthen Bay substation: 132 kV switchhouse (Balfour, Beatty & Co., Ltd.); Doncaster-West Melton: 132 kV overhead line (Watsham's Ltd.); and Uskmouth-Llantarnam: 132 kV overhead line (Balfour, Beatty & Co., Ltd.).

Seaside Illuminations

Mr. Noel-Baker, Minister of Fuel and Power, has informed the Holiday Resorts Committee of Members of Parliament that he anticipates that conditions in September and October will be such as to permit seaside illuminations to be switched on. It is possible, however, that some restrictions may have to be introduced or appeals made for economy when British Summer Time ends on 21st October.

Supply to Railways

Wimbledon Borough Council has been informed by the British Electricity Authority that the Authority will not now be proceeding with the proposal to erect a new generating station on railway property at Durnsford Road, and that as a result of separate discussions in connection with the change-over of frequency on the railway system, arrangements have been made for meeting the railways' requirements from the main transmission system which is to be supplemented by the construction of a new high-voltage grid.

Appeal Against Tariff

Although it agrees that standardization of domestic charges is desirable, the Yorkshire Electricity Consultative Council finds the tariff proposals of the Board unacceptable. The matter has been discussed with the Board and the B.E.A. without agreement being reached and arrangements have now been made for a deputation from the Council to meet officials of the B.E.A. in London later this month.

Distribution in Douglas

Douglas (I. of M.) Corporation Electricity Committee has approved the carrying out of a scheme, estimated to cost £21,150, for the extension and supplementation of the existing h.v. and l.v. mains network in the Onchan area and to facilitate the development of the Ballachrink estate by the Onchan Commissioners.

Street Lighting

HEBBURN-ON-TYNE U.D.C. has accepted the tender of the North-Eastern Electricity Board at £1,101 for the provision of street lighting on the Hartleyburn housing estate extension.

A new system of lighting (fluorescent and mercury discharge) is to be put into operation in the main streets of STOURBRIDGE within the next few weeks.

The lighting of a number of streets in part of the Hasland district of CHESTERFIELD is to be converted from gas to electricity.

New Nigerian Corporation

Under Nigerian Ordinance No. 15 of 1950 all Government electricity undertakings were transferred to the Electricity Corporation of Nigeria on 1st April. The principal executive officers of the Corporation are Mr. J. Houston Angus (chairman), Mr. J. A. C. Monahan (secretary), Mr. H. Batty (acting chief engineer) and Mr. E. C. Inston (liaison officer in U.K.). At present planning is in progress on extensive development schemes to provide a modern electricity network in Nigeria.

Activities of the E. A. W.

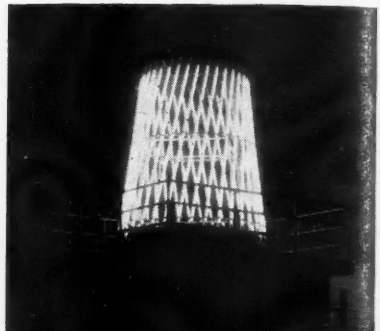
IN April the Manchester and Salford District Branch and the Birmingham and District Branch of the Electrical Association for Women celebrated their silver jubilees. On 23rd April Manchester began a week of celebrations with a reception by the Lord Mayor and Lady Mayoress, Col. S. P. Dawson and Mrs. Dawson in the Town Hall. This was followed by a dinner at the Midland Hotel when the toast of the City of Salford was proposed by Mrs. E. Mason, E.A.W. Branch chairman, and the response was made by the Mayor of Salford, Alderman F. Cowin, who was accompanied by Mrs. Cowin. The E.A.W. toast was proposed by Mr. H. F. Carpenter, secretary of the B.E.A., and the response was made by Dame Caroline Haslett, E.A.W. Director. Miss G. L. Entwisle proposed the toast of the guests, and the reply was given by Sir Joseph Hallsworth, chairman, North Western Electricity Board. On subsequent days visits were made to Ferranti, Ltd., B.I. Callender's Cables, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., the English Electric Co., Ltd., and the Kearsley power station.

On 27th April the Birmingham Branch celebrations took the form of a luncheon when the Branch president, Mrs. F. W. Lawton, was in the chair. The E.A.W. toast was proposed by Lord Citrine, chairman, B.E.A., and the response was made by Dame Caroline Haslett. The civic toast was proposed by the Branch chairman, Mrs. H. S. Davidson, and the Deputy Lord Mayor, Alderman G. H. Humphreys, responded. Lady Hacking replied to the toast of the guests.

On 1st May the Dowager Lady Swaythling, president of the Electrical Association for Women, opened the E.A.W. Festival of Britain Exhibition, "A Century of Progress in the Home", which is being held at 35, Grosvenor Place, London, S.W.1, until 30th September next. The exhibition has been designed with a view to emphasizing the contrast in the mode of living and in living conditions since a century ago. Models show how in 1851 very few, if any, attempts were made to save labour while the great changes which the introduction of electricity in the home has brought about, are shown by displays of the uses of modern domestic appliances.

London Airport Beacon

A new 7 kW identification beacon employing mercury-filled cold cathode fluorescent tubes has been added to the navigational aids at London Airport. The beacon, supplied and designed by the General Electric Co., Ltd., to meet M.C.A. requirements, under the technical direction of the chief mechanical and electrical engineer's department of the Air Ministry, gives a total light output from its 36 tubes of 180,000 lumens.



The identification beacon which has recently been installed at London Airport

The beacon flashes the airport identification letters in Morse five times a minute. The cold cathode tubes were made specially for the beacon by Claude-General Neon Lights, Ltd., an associated company of the G.E.C. Each consists of a lighting tube enclosed in an outer jacket to provide maximum efficiency at low ambient temperatures. The lighting tubes operate at 300 mA and are 30 mm in diameter. Their individual light output of 5,000 lumens compares with 2,125 lumens from the standard 20 mm diameter tube of the same lighting length (8ft 6in), but taking a current of 120 mA. Four tubes in series are operated from each of the nine transformers.

A three-phase supply has been made available for the beacon from an adjacent substation, where it is switched by means of contactors remotely operated from the airport control tower. A triple-pole switch-fuse is mounted in the beacon hut. One phase of the supply is used to operate the 1/15 h.p. capacitor motor which drives the cam causing the beacon to flash the Morse signals required. The same single-phase source energizes the coil of the three-phase lighting contactor under the control of contacts operated by the cam. A 20-A ironclad triple-pole and neutral fuseboard distributes the supply to the transformers.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The South Wales Switchgear Co., Ltd., held its annual meeting on 25th April when Sir George Usher (chairman), who presided, said that the extension of their factory at Blackwood was now complete and in full production. This had contributed to the increase of 45 per cent in their sales as compared with the previous year. As regards switchgear, they were now able to exploit the full 11 kV field including the 2,000 A 11 kV equipment for some of the largest distribution substations in the country. A commencement had been made with the development of 33 kV switchgear and it was hoped to start production in the current year. In the case of power transformers, the capacity had been extended from 1,000 kVA 11 kV to 5,000 kVA 33 kV. Work in progress amounted to £1,000,000, a record in the history of the company. A large proportion of the order book was concerned with export work, six-figure contracts being in progress for Pakistan and Australia.

The British Aluminium Co., Ltd.—In the course of his speech at the annual meeting held on 1st May, Mr. R. W. Cooper (chairman), said that their aluminium works at Burntisland and Newport had continued to operate satisfactorily, and the reconstruction of their reduction works at Kinlochleven had now been virtually completed. Work was still proceeding at Lochaber, but it was unlikely that benefits would accrue for some little time. Their rolling mills had increased their output over the previous year and much of the plant at the Falkirk mill extensions was available for operation. In reviewing the activities of the various subsidiary and associated companies, the chairman said that the Aluminium Wire & Cable Co. had received satisfactory orders. There had been some delay in the delivery of major items of plant and until these were installed the company could not be regarded as in full commercial operation.

Glenfield & Kennedy, Ltd.—The annual meeting will be held on 18th May. In his circulated statement, Mr. H. Corvan-Douglas (chairman), says that they have full order books, a large proportion of which is for export. In the year under review 37 per cent of their sales went overseas. Orders in hand for the home market include work for steam and hydro-electric power stations, oil refineries, water supplies, etc.

Johnson & Phillips, Ltd., report a trading profit (other than Scottish group) for the year ended 31st December last of £504,833, as compared with £606,871 for 1949, to which is added investment income of £17,049 and transfer fees, making £521,972. After meeting all charges and providing £210,000 for taxation, there is a net profit of £211,295 (against £253,793), to which is added £167,099 brought in, making £378,394. The ordinary dividend for the year is unchanged at 15 per cent and £170,860 is carried forward. The Scottish group shows a balance on profit and loss account of £14,603 (against £12,107).

The company proposes to create 1,250,000 4½ per cent £1 cumulative redeemable preference shares (1971-91) and to offer £1 million of these at par to ordinary shareholders in the proportion of three preference for every four ordinary. It is also proposed to create 666,250 further £1 ordinary shares, but there is no intention at the moment of issuing any. The proposals will be submitted to shareholders at a meeting to be held on 24th May. In a circular to shareholders Mr. G. L. Wates (chairman) says that the programme of normal development now in hand involves an expenditure of £300,000 during the next two or three years, and it is probable that further expenditure will be required in connection with the continued normal expansion of the company's operations.

Babcock & Wilcox, Ltd., report a group profit for 1950 of £1,651,771, as compared with £1,186,934 for the previous year, after deducting all charges, including £2,820,628 for United Kingdom taxation. This figure includes unrequired provisions of £96,936, sundry capital profits of £11,768, and transfer of £145,071 to tax equalization reserve. The net profit of the parent company is £1,639,047 (against £1,182,498). General reserve receives £650,000 and development reserve £150,000. It is proposed to pay a final ordinary dividend of 10 per cent, plus a cash bonus of 3 per cent, both less tax, making 18 per cent for the year. The total distribution for 1949 was 15 per cent, which included a final payment of 7 per cent and a bonus of 3 per cent.

Veritys, Ltd., report a trading loss for 1950 of £13,083, as compared with a profit of £20,674 for 1949. No dividend is paid on the

ordinary (against 2½ per cent). After providing for taxation, £1,462, depreciation, £10,280, and crediting profits and income and income tax recoverable, £6,510, there is a net loss of £18,315 (against a net profit of £4,036). A sum of £20,000 is transferred from general reserve and the balance carried forward is £16,679 (against £14,994 brought in).

The Telephone Manufacturing Co., Ltd., reports a group profit for 1950 after meeting all charges, including £128,998 for taxation, of £108,917, as compared with £127,449 for 1949. The amount attributable to the holding company is £97,922 (against £124,351). The ordinary dividend for the year is maintained at 10 per cent by a final payment of 7½ per cent.

Telephone Rentals, Ltd., reports a group profit for 1950, after all charges, of £239,236, as compared with £211,261 for the preceding year. The amount attributable to the holding company is £236,619 (against £209,461). The final dividend is 6 per cent, again making 10 per cent for the year.

The Power Securities Corporation, Ltd., reports a group profit for the past year of £145,520, as compared with £121,232 for the previous year. The ordinary dividend for the year is unchanged at 6 per cent.

The South African Electric Supply Commission.—The Cape Town Correspondent of the *Financial Times* reports that the Commission is issuing a £5 million 3¾ per cent loan at £99, maturing from 1964 to 1968. It will be used to finance a further portion of the expansion now under way.

T. Clarke & Co., Ltd., announce a "rights" issue of 2s ordinary shares at 4s on a one-for-four basis. The issue will amount to 154,538 shares.

Tube Investments, Ltd., has declared an interim ordinary dividend of 12½ per cent (unchanged).

Radio Rentals, Ltd., are paying an interim dividend of 10 per cent actual, less tax (same).

New Companies

Electra Finance Co., Ltd.—Registered 30th April. Capital £500,000. To acquire shares, stocks, funds, securities, etc. Directors: Sir Edward Wilshaw (director of Cable & Wireless (Holding), Ltd., etc.); Lord Pender, C.B.E. (director of Eastern Telegraph Co., Ltd., etc.); and C. E. Tavener (director of Cables Investment Trust, Ltd., etc.). Regd. office: Electra House, Victoria Embankment, W.C.2.

Powerco, Ltd.—Registered 22nd March. Capital £3,000. Manufacturers of and dealers in electrical plant, etc. F. W. Jelpke is permanent managing director. Regd. office: Wandsworth Town Station Works, York Road, S.W.18.

J. Sharp & Co. (Cardiff), Ltd.—Registered 28th March. Capital £600. Electrical engineers, general installation contractors, manufacturers and repairers of and dealers in dynamos, motors, etc. Directors: J. A. Sharp and K. J. Rowland. Secretary: K. J. Rowland. Regd. office: 41, St. Alban Avenue, Cardiff.

Unit Electrical Installation Co., Ltd.—Registered 27th March. Capital £3,000. To acquire the business of electrical engineers carried on by H. Evans and L. Warwick at Wednesfield as "The Unit Electrical Installation Co." Directors: H. Evans, Fanny E. Evans, L. Warwick and Marjorie Warwick. Secretary: H. Evans. Regd. office: 3, High Street, Wednesfield, Staffs.

J. R. Bush (Electrical Contractors), Ltd. Registered 5th April. Capital £1,000. Electrical engineers and contractors, etc. Directors: J. R. Bush (permanent) and W. J. E. Goodman. Secretary: Joan S. Bush. Regd. office: 1, Richmond Buildings, Dean Street, W.1.

Liquidations

Lauray Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. Boulton, Station Buildings, East Finchley, N.2. Particulars of claims to liquidator by 25th May.

Communiphone, Ltd.—Last day for receiving proofs for dividend 17th May. Liquidator, Mr. K. R. Cork, 19, Eastcheap, London, E.C.3.

Bankruptcies

A. A. Lumelino, lately trading as Star Electrical Service at Cranley Mews, South Kensington, London, S.W.5, electrical contractor.—Trustee, Mr. C. L. Walker, 2-3, Duke Street, St. James's, London, S.W.1, released 21st March.

A. M. Willmore, carrying on business at 45, King Street, Brighton, electrical and radio engineer.—Supplemental dividend of 17s 10d in the £, payable at the Official Receiver's Office, 8, Old Steine, Brighton.

C. Welbourn, formerly carrying on business at 158, Hykeham Road, Lincoln, as an electrical engineer and contractor.—Last day for receiving proofs for dividend 16th May. Trustee, Mr. G. H. Kelsey, 340, High Street, Lincoln.

R. Kendall, 66, Sheen Road, Richmond, Surrey, electrical dealer.—Receiving order made 1st May on debtor's own petition.

STOCKS and SHARES

STOCK EXCHANGE markets present a very satisfactory appearance, on the whole, to those who hold stocks and shares in commercial and industrial companies. The same description would hardly apply to proprietors of gilt-edged securities; in their case, the causes which make for strength in the industrial groups, have the opposite effect upon issues in the gilt-edged category. The investment appetite for industrial shares is extraordinarily keen. The price-lists published here last week showed a most unusual number of rises as compared with the prices of a month previously, and many of those rises were quite substantial. Since then, there have been further gains also, in a good many instances, of considerable amount.

Johnson & Phillips' Capital

Annual results of Johnson & Phillips were accompanied last week by notice from the company of the proposal to issue a million new 4½ per cent preference shares, redeemable 1971–91. At present, the capital is all in 1,333,750 ordinary shares. Holders of these are to be offered the preference at par on a three-for-four basis. In explaining the proposal, the circular refers to the £700,000 bank loan outstanding, and to the continued expansion of the business which, in the past five years, has absorbed £600,000 out of profits, as well as £650,000 from the last issue of ordinary shares and the capital profit on the take-over of the electric supply interests. Group trading profits for 1950 are lower at the net total, after tax, of £211,000, which is approximately twice the amount distributed in maintaining the dividend at 15 per cent. Following these announcements, the shares were quoted 2s 6d down, at 65s, at which they return £4 13s per cent.

Babcock & Wilcox Dividend

A rise of 5s 6d to 80s 6d in the price of Babcock & Wilcox £1 shares signalled market satisfaction with the increase in the year's distribution from 15 to a total of 18 per cent, both of which payments include 3 per cent under the heading of cash bonus. Expectations were fully fulfilled in that respect, and exceeded by the expansion of nearly half a million in the net profit, despite a very much higher charge for taxation. A return of 4½ per cent is shown on the new rate of distribution, which, according to the preliminary figures, involves less than half-a-million net out of more than £1½ million available.

Recent Issues

Wolf Electric Tools 5s ordinary shares have been in good demand since their placing in the market at about 5s 3d, the present quotation being in the neighbourhood of 8s 9d. In the advertisement of the issue at the end of March, a dividend at the rate of not less than 7½ per cent was mentioned as likely to be justified by the profits available. On that basis, the shares would pay 4½ per cent, a comparatively modest return. Brook Motors 10s ordinary shares, which were introduced to the market at about the same time at 33s stand now at about 37s 9d. In this case a dividend of at least 17½ per cent was mentioned in the prospectus, which foreshadowed a substantial rise in profits. The indicated yield is not less than 5 per cent.

Preference and Ordinary

In connection with the persistent migration of money from gilt-edged into equity investments, reference has been made in recent notes to the narrowing of the gap between the yields obtainable from one field and the other. In the case of preference shares, the swing towards equities has moved to the point where, in a number of cases, it is the ordinary which now show the smaller return on the basis of the latest dividends. Behind the movement is, of course, the feeling that the characteristics of the ordinary share may afford the better form of protection for capital, against the shrinking value of money. The consequent buoyancy of ordinary shares may be said to have been literally at the expense of fixed-interest stocks, since the volume of buying could scarcely have been financed out of the attenuated sums which taxpayers can save, in these days, for new investment.

Cases in Point

A few cases may be taken to illustrate the above trend. A return of 4½ per cent from Reyrolle 4 per cent preference goes against the yield of well under 3¾ per cent from the ordinary on the basis of the recently-declared dividend. English Electric ordinary, 3s 9d up on the week at 72s 6d., yield about 4½ per cent, or 3s less than do the 3¾ per cent preference. Respective yields on Ericssons 7 per cent preference and the ordinary are 4·9 and 4·1 per cent gross, while B.I.C. 5½ per cent preference pay about 5s per cent more than the ordinary. The list could be considerably lengthened, without reference to exceptionally low ordinary yields influenced by the approach of dividend dates, such as may be the case, for instance, with G.E.C., Automatic Telephone and Enfield Cables, all of which companies are due to make their declarations within the next month or two. In anticipation, General Electrics are 3s 3d better on the week at 95s 3d. Associated Electrical Industries are 2s 6d to the good at 97s 6d and C. A. Parsons at 90s are 3s 9d up.

Engineers-in-Charge

Closer Electrical Contacts Suggested

THE forty-sixth annual dinner of the Institution of Engineers-in-Charge was held on 4th May with the president, Mr. Robert Chalmers, in the chair, the company numbering nearly 200. The toast of "The Institution" was proposed by H. W. Swann (Senior Electrical Inspector of Factories), who referred to the great changes that had taken place in mechanical engineering since the founding of the Institution in July, 1895. The amount of electricity drawn from the public mains had doubled since 1939, and he emphasized, from his own experience, the importance to members (whose responsibilities were mainly in the mechanical field in varied industries and in hospitals and other institutions) of cultivating a close liaison with their electrical colleagues, especially in relation to earthing.

He suggested that more papers dealing with electricity might be presented at the meetings which were normally held on the second Wednesday of each month at Saint Bride's Institute, London. Perusal of the technical journals showed how difficult it was for specialists to keep abreast of changes and this difficulty would increase in the future. Drawing attention to the Safety, Health and Welfare (formerly the Industrial) Museum, Mr. Swann expressed the hope that the hon. secretary Capt. A. E. Penn, would write a history of the Institution.

Responding, the president claimed that the Institution covered a wider variety of subjects than any other association. The technical meetings had been most successful owing to the help rendered by eminent lecturers. Other means were also adopted for acquiring knowledge and self-culture and of developing character and promoting an understanding of the relation of an engineer's job to the community. All these things were symbolized by the Festival of Britain.

"Our Guests and Absent Friends" was proposed by Sir William J. Larke (immediate past-president). Regretting the absence of the presidents of the senior engineering institutions owing to their Festival duties, he said that these bodies had shown appreciation of the importance of engineers-in-charge by acting as "godfathers" to their Institution. It was inspiring to remember, in particular, the selfless devotion of people like the late Sir Charles Brassey and Mr. Percy Good. Engineers were concerned not only with immediate practical problems but also with work that raised the public's standard of living. The greater their knowledge the greater their responsibilities in that way and difficulties created opportunities. The British Standards Institution, which provided the channel through which criticisms of apparatus should go to the producers, was founded 50 years ago for the engineering industry. It had been so successful in giving a maximum of service for a minimum of cost that its sphere had been extended to cover all industries.

Response was made by Mr. A. R. Binney (Director, B.S.I.), who said that nearly 70 per cent of standardizing related to engineering. In its policy the B.S.I. was free from any Government control. British Standards were voluntarily produced and applied; they represented not regimentation but rather a crystallization of what was the best practice for the time being, research being directed towards finding the best way of doing anything until something still better was discovered. The needs of rearmament on top of other tasks presented a challenge to ingenuity and resource, but long-term views also were necessary, such as those connected with engineering aid to undeveloped countries. Thanks to the president for his keen interest in the educational and other activities of the Institution of Engineers-in-Charge was voiced by Mr. F. E. Shaw, the chairman.

Swedish Electricity Consumption

ELECTRICITY consumption in Sweden in 1950 amounted to 18,300 million kWh, corresponding to 2,600 kWh per inhabitant. Electrification is proceding rapidly and only some 50,000 rural homes, about 5 per cent of the total number, are still without electricity.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Instantaneous Water Heater

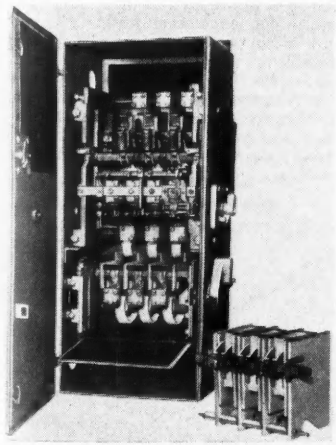
WEIGHING 4 lb and measuring 15in long by 3in in diameter, the "Gem" instantaneous water heater made by RODWAY JONES & CO., 36, Station Road, Westcliff-on-Sea, produces 1¼ pints of boiling water in 60 sec and 1¼ pints of hot water in 40 sec. Electricity is consumed only when hot water is being drawn off, the loading being 3 kW. The apparatus, which is designed for wall mounting, has its outer case stove enamelled, with chromium fittings. The price is £4 10s (plus £3 18s P.T. in this country); automatic control costs 10s extra.

Laundry Iron Control Unit

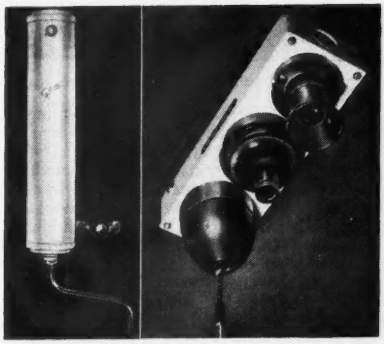
A laundry iron control unit, made by METALFORM, LTD., 258, Gray's Inn Road, London, W.C.1, has been accepted by the Council of Industrial Design for inclusion in "Design Review," 1951 Festival of Britain. It is mounted at ceiling height, the ceiling rose accommodating c.t.s. cable and allowing it to hang vertically to the iron, a much more convenient method than using trailing flex from a wall point. A pull switch controls the supply to the iron and the skirted indicator lampholder.

Air Break Circuit Breakers

Several interesting features are incorporated in the type A1 range of mechanically operated air break circuit breakers for up to 600 V a.c. circuits introduced by the ELECTRICAL APPARATUS CO., LTD., St. Albans, Herts. The 300 A size now in production is ASTA certified as having a rupturing capacity of 15 MVA at 600 V. The illustration shows a breaker in a standard industrial enclosure, but flameproof and mining types are also available, and an interlocked isolating switch can be incorporated.



E.A.C. type A1 breaker with arc box removed



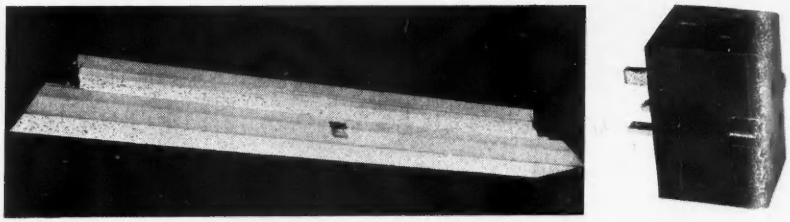
Above Left: **"Gem" water heater**
Right: **Metalform laundry iron control unit**

Each pole of the breaker is fitted with a patented arc box consisting of a series of insulated magnetizable plates carried between non-inflammable arc chutes. When the circuit breaker opens under load the arc reacts with the plates to set up a magnetic flux. This results in a blowout action which drives the arc between the plates where it is first split up into a number of arcs in series, and then extinguished rapidly due to the cooling action of the plates.

Any usual combination of overload releases with time lags and no-volt release can be incorporated and an earth leakage trip can be fitted.

Fluorescent Lighting in Garages

A departure in the design of industrial fluorescent lighting fittings is marked by the "Flarelite" fitting made by the STRONG ELECTRIC CORPORATION (GREAT BRITAIN), LTD., Hackbridge Mills, Hackbridge, Surrey, a number of which are being used by the London Transport Executive for general lighting in bus garages. Upward light is provided over a wide angle from the horizontal to practically the vertical,



Left: **Strong "Flarelite" fluorescent fitting.** *Right:* **Contactum 13 A socket adaptor**

the apertures for this purpose presenting an unbroken line of light from end to end of the reflector, without affecting the efficiency of the fitting. The body, which is integral with the reflector, carries all control gear and is easily detachable from the backplate without disturbing the wiring. The fitting, which is made in two sizes (4ft 40 W and 5ft 80 W), can be used for suspension or flush mounting, the design being such that the latter does not interfere with the full provision of the uplight. It is zinc plated and passivated before stove enamelling, making it suitable for use in places where humidity and extreme elements are present.

Electric Pulley Blocks

The three light-capacity electric chain pulley blocks in the "My-Te-Min" range made by GEO. W. KING, LTD., Hitchin, Herts, are designed to handle loads up to 400, 600 and 1,200 lb respectively. Two additional models are now available, one of 2,400 lb and the other of 3,600 lb capacity.

Cold Junction Thermostat

A cold junction thermostat introduced by SUNVIC CONTROLS, LTD., Sunvic House, Essex Street, London, W.C.2, comprises a cylindrical aluminium body housing the thermocouples and thermometer, around which is wound a small heater controlled by a proportioning thermostat to give control to within 0·1 deg C. The aluminium body is enclosed in a moulded container and the control mechanism is sealed. The instrument is supplied set to a temperature between 42 and 48 deg C and under normal conditions it will stabilize about 45 min after switching on, after which it will maintain its level despite changes in ambient temperature or mains voltage.

Sunvic cold junction thermostat and "My-Te-Min" electric chain pulley block

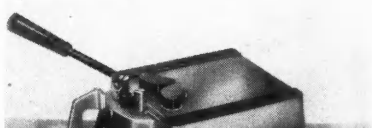
Three-Way 13 A Adaptor

A 13 A, three-pin, three-way, shuttered socket adaptor for use with B.S. 1363 socket outlets is now available from CONTACTUM, LTD., Victoria Works, Edgware Road, London, N.W.2. It is of moulded material and the shutter on each outlet operates independently of the other two. The price of the adaptor is 12s 8d.

Cable Stripper

A bench type cable stripper introduced by J. B. HYDE & CO., LTD., Altrincham Road, Wythenshawe, Manchester, accommodates cable up to $\frac{3}{8}$in diameter and has been designed expressly for production work. The cable is simply laid in position, correctly centred by an adjustable guide, and the hand lever pulled towards the operator. The stripper automatically grips the cable, cuts through the insulation, strips to the required length and releases the cable, all in one quick operation without splaying or otherwise damaging the conductors.

Hyde bench type cable stripper



Engineering in Europe

Survey of Current Literature

THE possibility of electrical fog precipitation has already been established by theory and experiment (see "*C.R. Acad. Sci.*" Vol. 224, p. 142, 1947). The problem involved is the efficacy, or range of attraction, of a charged spherular particle falling through a neutral fog consisting of inert particles of a radius smaller than that of the charged spherule. The probability of the capture of the fog particles depends on the inverse fifth power of their distance from the path of the falling charge ("electric scavenging radius"), the dielectric constant of the particle (which is probably high), the cube of the particle radius and square of the electric charge. A simplifying assumption made is that the height of the fall of the charged particle is small enough for its enlargement by captured fog particles to be neglected, so that the Stokes equation may be used. A good idea of the effect of electrical precipitation is obtained by an example in which "geometrical scavenging" (i.e., precipitation by uncharged particles) is compared with the electrical method. For geometrical removal of two-thirds of the fog particles in an area, 20 tons of matter per km^2 have to be dropped as against 550 kg/km^2 of charged particles, according to the simplified theory. A stricter theory considering hydrodynamical conditions would, for water spraying, require more than 130 tons/km^2 for geometrical precipitation—"Electrical Fog Precipitation," M. Pauthenier and N. Loutfoullah, *Comptes Rendus des Seances de l'Academie des Sciences*, Paris, Vol. 231, No. 19, pp. 953–956, 6th November, 1950, in French.

Van de Graaff Generators

The van de Graaff generator is the oldest and in some ways the least elaborate particle accelerator. As no standard type has been developed, each generator is an individual design and improvements of some kind or other are added in nearly every case, so that the machine, while used for practical work, is still in an advanced development stage. The main advantages of the generator are that it can handle all kinds of charged particles, for instance, electrons or ions provided by a suitable source (electron or ion gun) and raises their energy by mechanical convection through an electrostatic field. Full details of a new Swedish construction, namely, electrical insulation, design of the h.v. electrodes and corona-pillar, pressure-sealing, ion gun, acceleration tube, potential measurement by generating voltmeter, voltage stabilization, efficiency and cooling of the machine, radiation protection in X-ray operation, and impulse operation of the generator, and also comparative data of three new Swedish and two older Norwegian and U.S.A. generators are given in "Van de Graaff Generators." L. Beckman, *Teknisk Tidskrift*, Vol. 80, No. 44, pp. 1109–1115, 2nd December, 1950, in Swedish.

A.C. Magnets

Maxwell's formula for the attractive force of electromagnets, while forming the basis of the design of d.c. as well as a.c. magnets, is not sufficient for determining all the requisite parameters, because neither the effective flux density yielded by the formula nor the self-inductance found in this way corresponds to the values measured on actual magnets of the same rating. This is partly due to the fact that the formula does not consider leakage fluxes, and partly to necessary power reserve not allowed for by the formula. For instance, single-phase magnets require pole-shading by short-circuit rings which consume power not utilized for attraction. Also, the safe holding of the armature must be ensured, even if the voltage falls, and armature flutter prevented. This is especially important for contactors where flutter (i.e., vibrations of the armature) causes intermittent arcing with devastating effect on the service life of the contacts. Furthermore, the conditions are very different for hinged or plunger type armatures. Semi-empirical design method, illustrated by the

calculation of a numerical example, is developed, and design tables for the most important types of a.c. electromagnets are given in " Investigation on A.C. Magnets," W. Kussy, *Elektrotechnik*, Vol. 4, No. 12, pp. 404–409, December, 1950, in German.

Flashover in Compressed Air

The phenomena occurring when an insulator is flashed over are really breakdown processes in the ambient gas. This is proved by the fact that in tests on an insulator in a homogeneous field in dry air the flashover voltage of the insulator is identical with the breakdown voltage of the same distance in the absence of the insulator. There is no dependence on the material of the insulator or on gas pressure, except that at fairly high pressures the insulator is punctured rather than the gas. The conditions change a great deal when the gas is wet and a film of moisture exists on the insulator surface. The minimum value of the breakdown voltage in air saturated with water vapour is known as minimum voltage, and investigations on this value have been made up to air pressures of 24 atmospheres. The insulators used were cylindrical glass specimens of 0·6 to 6 cm long inserted between the electrodes of a plate spark gap. The minimum breakdown at high pressures is not preceded by a preliminary discharge. At high pressures the discharge phenomena take the character of discharges in an inhomogeneous spark gap, e.g., point-plate. This begins at 65 per cent relative humidity for glass and other wetting substances, at 90 per cent relative humidity for paraffin and non-wetting substances in general.—" The Minimum Voltage and the Discharge Phenomenon in the A.C. Flashover in Compressed Moist Air," H. Bocker, *Archiv für Elektrotechnik*, Vol. 40, No. 1, pp. 37–44, 1950, in German.

Ice Coatings on Contact Lines

The icing of contact lines of electric traction systems represents a danger to the operation of such systems more serious than the icing of transmission lines. Coatings of 0·2 to 0·4in thick may prevent contact between the current collector and the conductor and cause severe arcing, apart from the danger of upsetting the proper suspension of the contact line and even of breaking the conductor. The method evolved by V. V. Burgsdorf for high voltage overhead lines, of using heating current for fusing the ice coatings, has been found suitable in the case of contact wires. The fusing current must be fairly high but limited by the admissible maximum temperature of about 90 deg C, and by the time required for actual fusing of the ice, which must be determined. On the other hand, the ice coatings on the contact wires are more irregular. This introduces torsional stresses on the wire and the distortion angles are surprisingly high (in one case 375 deg). The paper describes the method and circuit for ice fusing (the rails of the permanent way being used as return lead) and gives a complete method of calculation for the fusing current in terms of conductor resistance, air temperature, wind speed and radiant heat transfer. Fusing times and costs of de-icing are found and the economy of the method demonstrated in " Electric Fusing of Ice Coatings on Contact Lines," G. K. Lytkin, *Elektrichestvo*, No. 11, pp. 28–32, November, 1950, in Russian.

Capacitor Bushings

Investigations have shown that the loss factor, while being a useful characteristic for the assessment of the quality and condition of a capacitor bushing, by no means tells the whole story. What the loss angle provides are indications of the quality of the material, moisture content, production errors and general condition of the insulation without, however, enabling conclusions to be drawn on the progress of ageing processes or internal erosions in the insulation due to ionization. Actually the bend of the curve of the loss factor does not always coincide with the limiting voltage determining incipient decay of the material. Regulations establishing ionization limits should not therefore be based on the bend of the loss factor curve. If these limits lie fairly low, they will still be unable to guarantee the absence of ionization, whereas, if they are too high, needless overdimensioning of the bushings will be the consequence. There is only one way of determining the ageing properties of a bushing, viz., the determination of the erosion voltages (i.e., voltage of corona inception in air $U_c = 1 \cdot 5d^{0.45}$, where d is the thickness of the dielectric layer) by prolonged tests.—" The Significance of the Loss Factor in the Assessment of Capacitor Bushings," H. Kappeler, *Elektrotechnik und Maschinenbau*, Vol. 68, No. 3, pp. 43–48, 1st February, 1951, in German.

NEW BOOKS

Engineering Metrology. By K. J. Hume, B.Sc., A.M.I.Mech.E., M.I.Prod.E. Pp. 293; figs. 123; index. Macdonald & Co. (Publishers), Ltd., 43, Ludgate Hill, London, E.C.4. Price 18s.

This book gathers together a great deal of information and data relating to the science of measurement in the field of mechanical engineering, which would not otherwise be readily accessible to many engineers and presents it in a most palatable form. It is assumed that the reader is familiar with normal workshop methods and measuring tools, such as micrometers and verniers, so no detailed descriptions of such equipment are included. Some of the more advanced work has necessarily been omitted; the treatment of screw threads, for example, has been restricted to parallel threads, and even this occupies two pages. Although line standard measurement, interferometry and similar work are the direct concern of but few metrologists sufficient material is included to give readers some knowledge of basic standards and modern advances in this field.

Dealing as it does with the theoretical and practical aspects of engineering dimensional measurement and including descriptions of typical modern instruments, apparatus and methods, this book will undoubtedly be of value to those taking metrology in the A.M.I.Mech.E. and A.M.I.Prod.E. examinations. It should also prove useful to all others who are either directly or indirectly concerned with precision dimensional measurement.—R.P.

Telecommunications Principles. By R. N. Renton, A.M.I.E.E. Pp. 450; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 37s 6d.

This book claims to be an exhaustive guide to telegraphy, telephony and radio and has been drawn up to cover all items in the City and Guilds examination syllabus for Telecommunications (Principles) Grades I, II and III. It includes a comprehensive theory of electricity and magnetism together with its application to generators, motors, transformers, measuring instruments and such like. In addition, space is devoted to the principles of sound and electronics.

The book is concisely written and clearly illustrated with the use of advanced mathematics either avoided or displaced to an appendix. Where appropriate, the chapters conclude with a summary, a number of worked examples from past City and Guilds examinations and a short list of references. Intending readers will find the summaries particularly useful as *aides-mémoire*.

Telecommunications is a broad term and it is clearly impracticable to include all its principles within the compass of a single volume. However, Mr. Renton has done well in his selection of material which must have proved difficult. Some aspects were a little neglected perhaps. Telegraphy might have deserved more than a few paragraphs, if only to justify the book's title. On the other hand, the chapters on electricity and magnetism are thorough and provide good basic information. There is little doubt that "Telecommunications Principles" is the best book available for the particular C. and G. examination.—D.S.R.

Books Received

Converting a Business into a Private Company. By Stanley Borrie (solicitor). 14th edition (54 pp.). Jordan & Sons, Ltd., Chancery Lane, London, W.C.2. Price 3s 6d.

Radio Technology. By B. F. Weller, A.M.I.E.E. Third edition. Pp. 420; figs. 122; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 30s.

Time Bases. By O. S. Puckle, M.B.E., M.I.E.E. Second edition. Pp. 387; figs. 257; index. Chapman & Hall, Ltd. Price 30s.

Design of Electrical Apparatus. By J. H. Kuhlmann and N. F. Tsang. Third edition. Pp. 512; figs. 262; index. Chapman & Hall, Ltd. Price 52s in U.K.

Electrical Technology for Beginners. By G. W. Stubbings, B.Sc., F.Inst.P., A.M.I.E.E. Third edition. Pp. 180; figs. 47; index. E. & F. N. Spon, Ltd., 15, Bedford Street, London, W.C.2. Price 9s.

Practical Wireless Service Manual. Edited by F. J. Camm. Ninth edition. Pp. 288; figs. 221; index. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 8s 6d.

Electric Power Stations. By T. H. Carr, M.I.E.E., M.I.Mech.E., M.I.C.E. Third edition. Pp. 821; figs. 624; index. Chapman & Hall, Ltd. Price 75s.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

753. Igranic Electric Co., Ltd.—Temperature-responsive control apparatus. 9th January, 1948. (654402.)

3731. Sciaky, D.—Conversion of polyphase current to unidirectional current impulses. 9th February, 1948. (654583.)

3954. Diamand, W.—Apparatus for recording of electric impulses. 11th March. 1949. (654584.)

4156. British Thomson-Houston Co., Ltd.—Ultra-high-frequency electric discharge devices of the magnetron type. 12th February, 1948. (654585.)

4217. Pemberton, M. E.—Electronic view-finders for television cameras. 12th February, 1949. (654413.)

5235. Hadley, V. J., and Hadley, N. C. (trading as Hadley Sound Equipments), and Kilminster, S. A.—Speech intercommunication systems between remote points. 18th February, 1949. (654586.)

5670. Marconi's Wireless Telegraph Co., Ltd.—Cathode-ray tubes. 25th February, 1948. (654417.)

5976. Director of the Office of Technical Services, Department of Commerce.—Triode oscillator tripler circuit. 27th February, 1948. (654419.)

6121. British Thomson-Houston Co., Ltd.—Television receiver circuits. 27th February, 1948. (654587.)

6186. Sylvania Electric Products, Inc.—Apparatus for separating particles of different charge-to-mass ratio. 27th February, 1948. (654588.)

6704. Brush Development Co.—Piezo-electric transducers. 3rd March, 1948. (654421.)

9106. Ellis, L. S. E. (Robertshaw-Fulton Controls Co.). —Electromagnetic control apparatus for fluid fuel burners. 31st March, 1948. (654429.)

9238. Igranic Electric Co., Ltd.—Electric motor control systems. 1st April, 1948. (654476.)

9271. McGuire, A. M., and Morrison, C. C.—Suction cleaners. 7th April, 1948. (654433.)

10430. Damien, N.—Electrolytic treatment of metallic surfaces. 14th April, 1948. (654435.)

11345. Compagnie des Freins et Signaux Westinghouse. —Push-pull rectifier of the barrier layer type for ultra-short waves. 26th April, 1948. (654436.)

11451. Marconi's Wireless Telegraph Co., Ltd., Beck, G. E., Graham, J. W., and Parker, G. P.—High-speed aeroplanes. 7th February, 1949. (654437.)

11770. Philips Electrical, Ltd.—Receiving devices for image transmission. 29th April, 1948. (654439.)

13269. Gamard, S.—Electric heating cloth. 14th May, 1948. (654447.)

14799. General Electric Co., Ltd., and Harrison, W.—Moulding presses. 31st May, 1949. (654455.)

16653. Evershed & Vignoles, Ltd., and Marchment, W. T.—Magneto mechanical systems. 21st June, 1949. (654519.)

17108. Standard Telephones & Cables, Ltd.—Image rejection circuits for superheterodyne receivers. 25th June, 1948. (654523.)

18975. Pearce, R. R.—Electrode assemblies for electron-discharge devices. 13th July, 1949. (654599.)

19639. Metropolitan-Vickers Electrical Co., Ltd.—Response controlled apparatus. 22nd July, 1948. (654490.)

20160. Fortiphone, Ltd., and Wolff, J.—Telephone receivers. 21st July, 1949. (654538.)

20838. British Thomson-Houston Co., Ltd.—Dynamo-electric machine. 6th August, 1948. (654543.)

21199. Pye, Ltd., and Allanson, D.—Deflecting coil arrangement for television receivers. 11th August, 1949. (654545.)

22321. Resistance Welders, Ltd., and Gordon, S. H.—Electric resistance welding machines. 24th August. 1949. (654601.)

24953. British Broadcasting Corporation, and Page, H. —Aerial systems. 23rd September, 1949. (654498.)

25418. Sangamo Weston, Ltd.—Electrical measuring instruments. 29th September, 1948. (654554.)

26097. Grubb, R. G., and Morris, S. W. M.—Separable electric joints or couplings. 5th October, 1949. (654500.)

26239. Owen, C. E.—Electric starting gear for engines or machines. 30th September, 1949. (654501.)

26968. Wheeldon, A. J. D., and Wheeldon, D. P.—Multiple-beam cathode-ray tubes. 14th October, 1949. (654502.)

28692. Goldfield, E. R.—Electric high-tension cable connector devices. 4th November, 1948. (654557.)

28896. Automatic Telephone & Electric Co., Ltd., Pearce, O. A., and Jones, E. W.—Automatic telephone systems. 12th October, 1949. (654505.)

30143. Standard Telephones & Cables, Ltd., and Mortlock, A.—Wireless receivers. 19th November, 1948. (654506.)

31156. Soc. d'Exploitation de Brevets.—Dynamo-electric convertors. 1st December, 1948. (654566.)

31273. British Telecommunications Research, Ltd., and Rechten, A. W.—Magnetic amplifiers. 1st December, 1949. (654569.)

31341. Electrolux, Ltd.—Absorption refrigerating apparatus. 3rd December, 1948. (654612.)

31524. British Thomson-Houston Co., Ltd.—Electronic counters. 6th December, 1948. (654616.)

31654. British Thomson-Houston Co., Ltd.—Methyl germanium compounds and methods of preparing the same. 7th December, 1948. (654571.)

33441. Sadir-Carpentier.—Electric pulse modulation circuit arrangements. 29th December, 1948. (654618.)

Foremanship Training

THE importance of adequate training courses for foremen has made a review of existing facilities imperative. A sub-committee of the British Institute of Management has made this survey and the results are now published, with the approval of the Ministry of Education, in a booklet entitled "Foremanship Training in Technical Colleges." The report, although it does not cover the whole field, shows up the deficiencies and suggests practical ways in which Technical Colleges may give immediate help. It proposes short-term programmes designed to appeal to the established foreman. Copies can be obtained from the Institute at Management House, 8, Hill Street, London, W.1, price 2s 6d.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Belfast.—25th May. Electricity Department. Fire extinguishing equipment. (See 4th May issue.)

British East Africa.—MOMBASA.—31st May. Municipal Board. Private automatic branch exchange. (C.R.E. (I.B.) 59226/51. Ten/2384.)*

Farnborough (Hants).—30th May. U.D.C. Supply of street lighting equipment. (See this issue.)

Middlewich.—16th May. U.D.C. Electrical wiring of 56 houses. (See 4th May issue.)

New Zealand.—WELLINGTON.—29th May. N.Z. Post Office. Supply of 38 miles of telephone cable. (C.R.E. (I.B.) 60016/51. Ten/2422.)*

Pakistan.—12th June. High Commissioner for Pakistan. Supply of 20,000 dry batteries. (See this issue.)

Preston.—Corporation. Electrical installation at Roebuck Street County Primary School. (See this issue.)

Slough.—19th May. Corporation. Street lighting equipment. (See 4th May issue.)

ORDERS PLACED

Cheltenham.—Borough Council. Accepted. Electrical installations in 70 "traditional" dwellings, Hesters Way Estate (£2,195).—Midlands Electricity Board.

Glasgow.—Housing Committee. Accepted. Three electric passenger lifts in multi-storey flats, Crathie Drive (£11,039).—Waygood-Otis, Ltd.

Transport Committee. Accepted. Trolley-bus overhead line equipment for the Clarkston/Garscube Road route (£64,085).—Clough Smith & Co., Ltd.

Education Committee. Accepted. Electrical works at Dalbeth School (£936).—Corporation Central Electrical Workshops.

Middlesbrough.—Town Council. Installation of emergency lighting at central baths (£513).—A. Anderson & Son.

Seaton Valley.—U.D.C. Electrical installations in 14 houses at Cramlington and 50 at Seghill.—J. B. Wilson, Whitley Bay.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alston (Cumb).—Further 16 houses, Firs site, for R.D.C.; Graham and Roy, architects, Paternoster Row, Carlisle.

Andover.—Primary school, Upton (£25,394) for Hants E.C.; Rabbets and Wilkes, builders, Ashley Road, Parkstone.

Ashington.—Additions to Ashington General Hospital and former isolation hospital for Newcastle Regional Hospital Board (£180,000); P. H. Knighton, Board's chief architect.

Atcham.—Houses (40), Ford site; J. R. Sockett, R.D.C. surveyor, 24, St. John's Hill, Shrewsbury.

Barnard Castle.—Houses (39), Victoria Road; North-Eastern Housing Association, Metrovick House, Northumberland Road, Newcastle-on-Tyne.

Basildon (Essex).—Houses (112), near Pitsea, for Development Corporation; chief architect, Gifford House, Pitsea.

Bedford.—Flats (72), New Mile Road estate (£69,926); W. J. Busby, Ltd., builders, 30, High Street, Kempston.

Billingham-on-Tees.—Houses (80), Roseberry Road site, for the U.D.C.; S. Coates, Ltd., builders, Langbaurgh Place, Middlesbrough.

Birmingham.—Reconstruction, etc., Aston Fire Station, Ettington Road; H. J. Manzoni, city engineer, Civic Centre.

Grammar and technical school at Garretts Green, Sheldon (1951/2 programme); city engineer.

Blackburn.—Houses (78), Clarendon Road and Green Lane sites; John Laing & Son, builders, Mill Hill, London, N.W.7.

Brackley (Northants).—Houses (24), Waynflete Avenue; U.D.C. surveyor.

Bridgnorth (Salop).—Council chamber and offices for R.D.C.; A. Butler, architect, 14, Waterloo Road, Wolverhampton.

Brighton.—Extension to No. 2 factory, Hollingbury (£52,410) for Underwood, Elliott Fisher, Ltd.; Rice & Son, Ltd., Brighton.

Old people's home, Lower Bevendean estate (£32,917); town clerk.

Ambulance station, Elm Grove (£18,561); F. T. Wilson & Sons, Ltd., Brighton.

Houses, Parkside estate; W. H. Soper, Hove (25 houses) and T. J. Braybon & Son, Ltd., Brighton (37 houses).

Bromley.—Flats (24), Tylney Road; H. Payne Wyatt, Son and Partner, architects, 465, Brixton Road, S.W.9.

Dwellings (139), second stage of Hayes Place site; Dalgleish and Pullen, architects, 17, Fitzhardinge Street, W.1.

Cambridge.—Houses, Queen Edith's Way (56), and Coleridge Road estate (16); city engineer, The Guildhall.

Carlton.—Houses (32), Fraser Road; M. D. Sweeney & Palmer, Ltd., Aspley, Nottingham.

Chelmsford.—Shops (8) and flats (29), Byron Road, Springfield; E. R. Collister, architect, 67, London Road.

Chesterfield.—Houses (70), Calow Lane; borough surveyor.

Chigwell (Essex).—Flats (16) and maisonnettes (22) for U.D.C.; White and Mileson, architects, Old Station Road, Loughton.

Colwyn Bay.—Houses (16), Albert Road; T. A. Hughes, Ltd., Colwyn.

Coseley.—Further 45 houses, Batmans Hill site, for U.D.C.; K. E. Millard & Co., Ltd., New Wolverhampton Road, Langley, Oldbury.

Droitwich.—Three blocks of flats (£12,231), Dilmore Lane, for R.D.C.; R. W. Morris, Ltd.

Guildford.—Houses (98), Bushey Hill; T. Higgs & Co., builders, Woodham Lane, Woking.

Ipswich.—Houses (124), Chantry estate; borough surveyor.

Jarrow-on-Tyne.—Factory, Chaytor Street; Remploy, Ltd.

Hostel for aged people (£30,000); county architect, Court Lane, Durham.

Houses (38) and flats (48), Simonside estate; borough engineer.

London.—Sydenham.—Flats (138), Sydenham Hill, for Camberwell B.C.; A. W. Kenyon, architect, 15, Adeline Place, W.C.1.

Manchester.—Nurses' home at Jewish Memorial Hospital for Regional Hospital Board (£54,662); W. Fearnley & Sons (Salford), Ltd., Constance Works, Eccles New Road, Salford, 5.

Factory, Wythenshawe estate, for Dunlop, Ltd., Birmingham; F. Wilson, chief architect.

Merthyr Tydfil.—Houses (104), Swansea Road estate; borough engineer.

Mold.—Houses (51), Bromley estate; F. C. Roberts, architect to U.D.C., Earl Chambers.

Morecambe.—Houses (24), Blackberry Hall estate; Heysham Building Co., Ltd., Higher Heysham.

Flats, Trumacar Lane estate; J. Westwell, 11, Banksome Drive, Morecambe.

Newton Aycliffe.—Houses (180) and 11 shops and flats for the Aycliffe Development Corporation, Newton Aycliffe.

North Shields.—Rebuilding fish oil factory at Tanners Bank for R. Irvin & Sons, Ltd.; Tasker and Child, architects, Trinity Buildings, New Bridge Street, Newcastle-on-Tyne.

Nuneaton.—St. Joseph's R.C. Secondary School; S. N. Cooke and Partners, architects, Sun Buildings, Bennetts Hill, Birmingham.

Peterborough.—Extensions to out-patients' department, Memorial Hospital (£19,777); C. Jellings, Ltd., builders, Cobden Street, Peterborough.

Portland.—Houses (132), Verne Common site; U.D.C. surveyor.

Portslade.—Houses (40), Mile Oak site, for U.D.C.; Geo. W. Warr and King, architects, 137, Albion Street, Southwick.

Portsmouth.—Factory, Southampton Road, Paulsgrove; Smith's Potato Crisps, Ltd.

Reading.—Extensions to bakery (£40,000), for Co-operative Society, Ltd., Cheapside; Sainsbury and Chamberlain, architects, 14, Cross Street.

Rochdale.—Extensions at Birch Hill Hospital (£220,000); Harry S. Fairhurst & Son, architects, 55, Brown Street, Manchester.

Scarborough.—County school at Eastfield, Cayton, for North Riding E.C.; F. Barraclough, Education Offices, County Hall, Northallerton.

Shipley.—Houses (88), section 2 of Owlet Hall estate; U.D.C. surveyor.

South Shields.—Three factories to rehouse firms to be displaced under the T.C.'s development plan (£70,000); borough engineer.

Stockton-on-Tees.—R.C. primary school, Durham Road; R. Burke, architect, Lambton Road, Jesmond, Newcastle-on-Tyne.

Stretford.—Rebuilding junior library, and extensions and reconstruction, King Street Central Library; Howard and Benson, architects, 88, Mosley Street, Manchester, 2.

Sunderland.—Rebuilding bomb-damaged Atlas Furniture Works; F. J. Hepple, builder, Dunn Street, Newcastle-on-Tyne.

Surbiton.—Factory, Roebuck Road; Gattey (Kingston), Ltd., Derby Road, Surbiton.

Thirsk.—Houses (11), Croft Heads, for R.D.C.; Needham, Thorp and White, architects, 6, High Petergate, York.

Urmston.—Boys' secondary school, Irlam Road; Moston Brick & Building Co., Ltd., Manchester.

Uttoxeter.—Further 26 houses, Bently House estate, for U.D.C.; O'Dair Bros., Ltd., Uttoxeter Old Road, Tean.

Walthamstow.—Houses (35), Blackhorse Lane and Billet Road, for Lee Conservancy Board; Ley Colbeck and Partners, architects, Palmerston House, 51, Bishopsgate, E.C.2.

Watford.—Secondary modern school at Woodside (£166,650), for Herts E.C.; county architect, County Hall, Hertford.

Wellingborough.—Stage 1 of rebuilding St. Barnabas Church; Robert Marriott, Ltd., Rushden.

Wigan.—Secondary technical school and college of further education, Rectory Glebe site; Leonard Fairclough, Ltd., Adlington; Grenfell Baines Group, architects, Guildhall Street, Preston.

Wrexham.—Houses and flats at Barons Road (21) and The Pines (16); borough engineer.